THE

AMERICAN NATURALIST.

VOL. XV. — *MARCH*, 1881. — No. 3.

OBSERVATIONS ON THE SALMON OF THE PACIFIC.

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DURING the most of the present year, the writers have been engaged in the study of the fishes of the Pacific coast of the United States, in the interest of the U. S. Fish Commission and the U. S. Census Bureau. The following pages contain the principal facts ascertained concerning the salmon of the Pacific coast. It is condensed from our report to the U. S. Census Bureau, by permission of Professor Goode, assistant in charge of fishery investigations.

There are five species of salmon (Oncorhynchus) in the waters of the North Pacific. We have at present no evidence of the existence of any more on either the American or the Asiatic side.

These species may be called the quinnat or king salmon, the blue-back salmon or red-fish, the silver salmon, the dog salmon, and the hump-back salmon or *Oncorhynchus chouicha*, *nerka*, *kisutch*, *keta* and *gorbuscha*. All these species are now known to occur in the waters of Kamtschatka as well as in those of Alaska and Oregon.

As vernacular names of definite application, the following are on record:

a. Quinnat—Chouicha, king salmon, e'quinna, saw-kwey, Chinnook salmon, Columbia River salmon, Sacramento salmon. tyee salmon, Monterey salmon, deep-water salmon, spring salmon, ek-ul-ba ("ekewan") (fall run).

b. Blue-back—krasnaya ryba, Alaska red-fish, Idaho red-fish, sukkegh, Frazer's river salmon, rascal, oo-chooy-ha.

c. Silver salmon—kisutch, winter salmon, hoopid, skowitz, coho, bielaya ryba, o-o-wun.

d. Dog salmon—kayko, lekai, ktlawhy, qualoch, fall salmon, o-le-a-rah. The males of *all* the species in the fall are usually known as dog salmon, or fall salmon.

e. Hump-back—gorbuscha, haddo, hone, holia, lost salmon, Puget Sound salmon, dog salmon (of Alaska).

Of these species, the blue-back predominates in Frazer's river, the silver salmon in Puget sound, the quinnat in the Columbia and the Sacramento, and the silver salmon in most of the small streams along the coast. All the species have been seen by us in the Columbia and in Frazer's river; all but the blue-back in the Sacramento, and all but the blue-back in waters tributary to Puget sound. Only the quinnat has been noticed south of San Francisco, and its range has been traced as far as Ventura river, which is the southernmost stream in California which is not muddy and alkaline at its mouth.

Of these species, the quinnat and blue-back salmon habitually "run" in the spring, the others in the fall. The usual order of running in the rivers is as follows: *nerka, chouicha, kisutch, gorbuscha, keta.*

The economic value of the spring running salmon is far greater than that of the other species, because they can be captured in numbers when at their best, while the others are usually taken only after deterioration.

The habits of the salmon in the ocean are not easily studied. Quinnat and silver salmon of every size are taken with the seine at almost any season in Puget sound. The quinnat takes the hook freely in Monterey bay, both near the shore and at a distance of six or eight miles out. We have reason to believe that these two species do not necessarily seek great depths, but probably remain not very far from the mouth of the rivers in which they were spawned.

The blue-back and the dog salmon probably seek deeper water, as the former is seldom or never taken with the seine in the ocean, and the latter is known to enter the Straits of Fuca at the spawning season.

The great majority of the quinnat salmon and nearly all the blue-back salmon enter the rivers in the spring. The run of both begins generally the last of March; it lasts, with various modifications and interruptions, until the actual spawning season in November; the time of running and the proportionate amount of

each of the subordinate runs, varying with each different river. In general, the runs are slack in the summer and increase with the first high water of autumn. By the last of August only straggling blue-backs can be found in the lower course of any stream, but both in the Columbia and the Sacramento the quinnat runs in considerable numbers till October at least. In the Sacramento the run is greatest in the fall, and more run in the summer than in spring. In the Sacramento and the smaller rivers southward, there is a winter run, beginning in December.

The spring salmon ascend only those rivers which are fed by the melting snows from the mountains, and which have sufficient volume to send their waters well out to sea. Such rivers are the Sacramento, Rogue, Klamath, Columbia and Frazer's rivers.

Those salmon which run in the spring are chiefly *adults* (supposed to be at least three years old). Their milt and spawn are no more developed than at the same time in others of the same species which will not enter the rivers until fall. It would appear that the contact with cold fresh water, when in the ocean, in some way caused them to turn toward it and to "run," before there is any special influence to that end exerted by the development of the organs of generation.

High water on any of these rivers in the spring is always followed by an increased run of salmon. The canners think, and this is probably true, that salmon which would not have run till later, are brought up by the contact with the cold water. The cause of this effect of cold fresh water is not understood. We may call it an instinct of the salmon, which is another way of expressing our ignorance. In general, it seems to be true that in those rivers and during those years when the spring run is greatest, the fall run is least to be depended on.

As the season advances, smaller and younger salmon of these two species (quinnat and blue-back) enter the rivers to spawn, and in the fall these young specimens are very numerous. We have thus far failed to notice any gradations in size or appearance of these young fish by which their ages could be ascertained. It is, however, probable that some of both sexes reproduce at the age of one year. In Frazer's river, in the fall, quinnat male grilse of every size, from eight inches upwards, were running, the milt fully developed, but usually not showing the hooked jaws and dark colors of the older males. Females less than eighteen

inches in length were rare. All, large and small, then in the river, of either sex, had the ovaries or milt well developed.

Little blue-backs of every size down to six inches are also found in the Upper Columbia in the fall, with their organs of generation fully developed. Nineteen-twentieths of these young fish are males, and some of them have the hooked jaws and red color of the old males.

The average weight of the quinnat in the Columbia, in the spring, is twenty-two pounds; in the Sacramento about sixteen. Individuals weighing from forty to sixty pounds are frequently found in both rivers, and some as high as eighty pounds are reported. It is questioned whether these large fishes are: *(a.)* Those which, of the same age, have grown more rapidly; *(b.)* Those which are older but have, for some reason, failed to spawn; or *(c.)* Those which have survived one or more spawning seasons. All of these origins may be possible in individual cases; we are, however, of the opinion that the majority of these large fish are those which have hitherto run in the fall and so may have survived the spawning season previous.

Those fish which enter the rivers in the spring, continue their ascent until death or the spawning season overtakes them. Probably none of them ever return to the ocean, and a large proportion fail to spawn. They are known to ascend the Sacramento as far as the base of Mount Shasta, or to its extreme head-waters, about four hundred miles. In the Columbia they are known to ascend as far as the Bitter Root mountains, and as far as the Spokan falls, and their extreme limit is not known. This is a distance of six to eight hundred miles.

At these great distances, when the fish have reached the spawning grounds, besides the usual changes of the breeding season, their bodies are covered with bruises on which patches of white fungus develop. The fins become mutilated, their eyes are often injured or destroyed; parasitic worms gather in their gills, they become extremely emaciated, their flesh becomes white from the loss of the oil, and as soon as the spawning act is accomplished, and sometimes before, all of them die. The ascent of the Cascades and the Dalles probably causes the injury or death of a great many salmon.

When the salmon enter the river they refuse bait, and their stomachs are always found empty and contracted. In the rivers

they do not feed, and when they reach the spawning grounds their stomachs, pyloric cœca and all, are said to be no larger than one's finger. They will sometimes take the fly, or a hook baited with salmon roe, in the clear waters of the upper tributaries, but there is no other evidence known to us that they feed when there. Only the quinnat and blue-back (then called red-fish) have been found in the fall at any great distance from the sea.

The spawning season is probably about the same for all the species. It varies for all in different rivers and in different parts of the same river, and doubtless extends from July to December.

The manner of spawning is probably similar for all the species, but we have no data for any except the quinnat. In this species the fish pair off, the male, with tail and snout, excavates a broad shallow "nest" in the gravelly bed of the stream, in rapid water, at a depth of one to four feet; the female deposits her eggs in it and after the exclusion of the milt they cover them with stones and gravel. They then float down the stream tail foremost. A great majority of them die. In the head-waters of the large streams all die, unquestionably. In the small streams, and near the sea, an unknown percentage *probably* survive. The young hatch in about sixty days, and most of them return to the ocean during the high water of the spring.

The salmon of all kinds in the spring are silvery, spotted or not according to the species, and with the mouth about equally symmetrical in both sexes.

As the spawning season approaches the female loses her silvery color, becomes more slimy, the scales on the back partly sink into the skin, and the flesh changes from salmon red and becomes variously paler, from the loss of the oil; the degree of paleness varying much with individuals and with inhabitants of different rivers

In the lower Sacramento the flesh of the quinnat in either spring or fall is rarely pale. In the Columbia, a few with pale flesh are sometimes taken in spring, and a good many in the fall. In Frazer's river the fall run of the quinnat is nearly worthless for canning purposes, because so many are white meated. In the spring very few are white meated, but the number increases towards fall, when there is every variation, some having red streaks running through them, others being red toward the head and pale toward the tail. The red and pale ones cannot be distinguished exter-

nally, and the color is dependent neither on age nor sex. There is said to be no difference in the taste, but there is no market for canned salmon not of the conventional orange color.

As the season advances, the differences between the males and the females become more and more marked, and keep pace with the development of the milt, as is shown by dissection.

The males have: *(a.)* The premaxillaries and the tip of the lower jaw more and more prolonged, both of them becoming finally strongly and often extravagantly hooked, so that either they shut by the side of each other like shears, or else the mouth cannot be closed. *(b.)* The front teeth become very long and canine-like, their growth proceeding very rapidly, until they are often half an inch long. *(c.)* The teeth on the vomer and tongue often disappear. *(d.)* The body grows more compressed and deeper at the shoulders, so that a very distinct hump is formed; this is more developed in *O. gorbuscha*, but is found in all. *(e.)* The scales disappear, especially on the back, by the growth of spongy skin. *(f.)* The color changes from silvery to various shades of black and red or blotchy, according to the species. The blue-back turns rosy red, the dog salmon a dull, blotchy red, and the quinnat generally blackish.

These distorted males are commonly considered worthless, rejected by the canners and salmon-salters, but preserved by the Indians. These changes are due solely to influences connected with the growth of the testes. They are not in any way due to the action of fresh water. They take place at about the same time in the adult males of all species, whether in the ocean or in the rivers. At the time of the spring runs, all are symmetrical. In the fall, all males of whatever species are more or less distorted. Among the dog salmon, which run only in the fall, the males are hook-jawed and red-blotched when they first enter the Straits of Fuca from the outside. The hump-back, taken in salt water about Seattle, shows the same peculiarities. The male is slab-sided, hook-billed and distorted, and is rejected by the canners. No hook-jawed *females* of any species have been seen.

It is not positively known that any hook-jawed male survives the reproductive act. If any do, their jaws must resume the normal form.

On first entering a stream the salmon swim about as if playing: they always head towards the current, and this "playing" may be

simply due to facing the flood tide. Afterwards they enter the deepest parts of the stream and swim straight up, with few interruptions. Their rate of travel on the Sacramento is estimated by Stone at about two miles per day; on the Columbia at about three miles per day.

As already stated, the economic value of any species depends in great part on its being a "spring salmon." It is not generally possible to capture salmon of any species in large numbers until they have entered the rivers, and the spring salmon enter the rivers long before the growth of the organs of reproduction has reduced the richness of the flesh. The fall salmon cannot be taken in quantity until their flesh has deteriorated; hence the "dog salmon" is practically almost worthless, except to the Indians, and the hump-back salmon is little better. The silver salmon, with the same breeding habits as the dog salmon, is more valuable, as it is found in Puget sound for a considerable time before the fall rains cause the fall runs, and it may be taken in large numbers with seines before the season for entering the rivers. The quinnat salmon, from its great size and abundance is more valuable than all other fishes on our Pacific coast together. The blue-back, similar in flesh but much smaller and less abundant, is worth much more than the combined value of the three remaining species.

The fall salmon of all species, but especially the dog salmon, ascend streams but a short distance before spawning. They seem to be in great anxiety to find fresh water and many of them work their way up little brooks only a few inches deep, where they soon perish miserably, floundering about on the stones. Every stream, of whatever kind, has more or less of these fall salmon.

It is the prevailing impression that the salmon have some special instinct which leads them to return to spawn in the same spawning grounds where they were originally hatched. We fail to find any evidence of this in the case of the Pacific coast salmon, and we do not believe it to be true. It seems more probable that the young salmon, hatched in any river, mostly remain in the ocean within a radius of twenty, thirty or forty miles of its mouth. These, in their movements about in the ocean, may come into contact with the cold waters of their parent rivers, or perhaps of any other river, at a considerable distance from the shore. In the case of the quinnat and the blue-back, their "instinct" leads

them to ascend these fresh waters, and in a majority of cases these waters will be those in which the fishes in question were originally spawned. Later in the season the growth of the reproductive organs leads them to approach the shore and to search for fresh waters, and still the chances are that they may find the original stream. But undoubtedly many fall salmon ascend, or try to ascend, streams in which no salmon was ever hatched.

It is said of the Russian river and other California rivers, that their mouths in the time of low water in summer, generally become entirely closed by sand bars, and that the salmon in their eagerness to ascend them, frequently fling themselves entirely out of water on the beach. But this does not prove that the salmon are guided by a marvelous geographical instinct which leads them to their parent river. The waters of Russian river soak through these sand bars and the salmon "instinct," we think, leads them merely to search for fresh waters.

This matter is much in need of further investigation; at present, however, we find no reason to believe that the salmon enter the Rogue river simply because they were spawned there, or that a salmon hatched in the Clackamas river is any the more likely on that account to return to the Clackamas than to go up the Cowlitz or the Deschûtes.

"At the hatchery on Rogue river, the fish are stripped, marked and set free, and every year since the hatchery has been in operation some of the marked fish have been re-caught. The young fry are also marked, but none of them have been re-caught."

This year the run of silver salmon in Frazer's river was very light, while on Puget sound the run was said by the Indians to be greater than ever known before. Both these cases may be due to the same cause, the dry summer, low water and consequent failure of the salmon to find the rivers. The run in the sound is much more irregular than in the large rivers. One year they will abound in one bay and its tributary stream and hardly be seen in another, while the next year the condition will be reversed. At Cape Flattery the run of silver salmon for the present year was very small, which fact was generally attributed by the Indians to the birth of twins at Neah bay.

In regard to the diminution of the number of salmon on the coast. In Puget's sound, Frazer's river and the smaller streams, there appears to be little or no evidence of this. In the Columbia,

river the evidence appears somewhat conflicting; the catch during the present year (1880) has been considerably greater than ever before (nearly 540,000 cases of 48 lbs. each having been packed), although the fishing for three or four years has been very extensive. On the other hand, the high water of the present spring has undoubtedly caused many fish to become spring salmon which would otherwise have run in the fall. Moreover, it is urged that a few years ago when the number caught was about half as great as now, the amount of netting used was perhaps one-eighth as much. With a comparatively small outfit the canners caught half the fish, now with nets much larger and more numerous, they catch them all, scarcely any escaping during the fishing season (April 1 to August 1). Whether an actual reduction in the number of fish running can be proven or not, there can be no question that the present rate of destruction of the salmon will deplete the river before many years. A considerable number of quinnat salmon run in August and September, and some stragglers even later; these now are all which keep up the supply of fish in the river. The non-molestation of this fall run, therefore, does something to atone for the almost total destruction of the spring run.

This, however, is insufficient. A well ordered salmon hatchery is the only means by which the destruction of the salmon in the river can be prevented. This hatchery should be under the control of Oregon and Washington, and should be supported by a tax levied on the canned fish. It should be placed on a stream where the quinnat salmon actually come to spawn.

It has been questioned whether the present hatchery on the Clackamas river actually receives the quinnat salmon in any numbers. It is asserted, in fact, that the eggs of the silver salmon and dog salmon, with scattering quinnat, are hatched there. We have no exact information as to the truth of these reports, but the matter should be taken into serious consideration.

On the Sacramento there is no doubt of the reduction of the number of salmon; this is doubtless mainly attributable to overfishing, but in part it may be due to the destruction of spawning beds by mining operations and other causes.

As to the superiority of the Columbia river salmon; there is no doubt that the quinnat salmon average larger and fatter in the Columbia than in the Sacramento and in Puget sound. The dif-

ference in the canned fish is, however, probably hardly appreciable. The canned salmon from the Columbia, however, bring a better price in the market than those from elsewhere. The canners there generally have had a high regard for the reputation of the river, and have avoided canning fall fish or species other than the quinnat. In the Frazer's river the blue-back is largely canned, and its flesh being a little more watery and perhaps paler, is graded below the quinnat. On Puget sound, various species are canned; in fact, everything with red flesh. The best canners on the Sacramento apparently take equal care with their product with those of the Columbia, but they depend largely on the somewhat inferior fall run. There are, however, sometimes salmon canned in San Francisco, which have been in the city markets, and for some reason remaining unsold, have been sent to the canners; such salmon are unfit for food, and canning them should be prohibited.

The fact that the hump-back salmon runs only on alternate years in Puget sound (1875, 1877, 1879, etc.) is well attested and at present unexplained. Stray individuals only are taken in other years. This species has a distinct "run," in the United States, only in Puget sound, although individuals (called "lost salmon") are occasionally taken in the Columbia and in the Sacramento.

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THE SIPHONOPHORES.

II.—THE ANATOMY AND DEVELOPMENT OF AGALMA (CONTINUED).

BY J. WALTER FEWKES.

THE key to the zoölogical affinities of *Agalma*, the adult structure of which has been given in a previous article,[1] is to be found in its embryology or the development from the egg. To that subject I propose to devote the present article, as it is impossible in the case of this jelly fish, to discuss its morphological relationship from the study of anatomy alone.

In this discussion I shall consider, in the first place, the development of the *Agalma* from the egg, and in the second, the growth of new buds along the axis to form those new parts, the adult forms of which have already been described in some detail. The former division includes the consideration of the changes in form which the colony as a whole passes through in the growth from an egg to an adult like Fig. 1; the latter, the development of each of the different members of the community, or their growth from buds formed on an axis already well developed.

[1] NATURALIST, 1880, p. 617.

I. DEVELOPMENT OF THE EGG.

The new *Agalma* always begins its growth from an egg. I know of no case where any other method of origin than from an egg takes place among Siphonophores. Alexander Agassiz describes in *Agalmopsis cara* a reproduction by a bud from the stem, and says that this bud has a well-developed float before it separates from the stem or axis. In *Agalmopsis picta*, a species closely allied to *Agalmopsis cara*, no such budding of a new colony takes place. In the excellent volume already quoted, entitled "Seaside Studies in Natural History," it is suggested[1] that those organs which I have called "tasters," drop off and develop into new colonies. I consider this supposition improbable as far as any known genus of tubular jelly fishes is concerned. In the genus *Agalma*, as before stated, reproduction is always from the egg.

I was fortunate enough to find in the glass vessel in which the first *Agalma* captured by me was confined, that the water was filled with minute transparent spheres, no larger than the head of a pin. They floated about in the liquid, and were not limited to any definite depth, but when the contents of the glass became quiet, all rose to the surface, and thickly crowded together, covered it like so many small oil-globules. When they had collected in this way, I was able by means of a watch crystal to skim them off, and transfer all into a more convenient receptacle for study.

These little oil-globule-like spheres were originally cast into the water from the female sexual bells, and are eggs, from each one of which grows a new *Agalma*. The female bells are found in grape-like cluster just below the feeding polyps, and appear to take the form of individuals, which have apportioned to themselves the single function of reproduction of new *Agalmata*. They have no stomach nor mouths, but draw their nourishment from the cavity of the axis into which it has been poured by those individuals of the colony, which do all the eating for the *Agalma*. Each bell contains a single egg, and after that egg has been cast, the bell withers up, or is absorbed into the stem, or sometimes before the egg escapes, breaks loose from its connection with the axis, and drops into the water with the contained egg. The last process takes place by a rupture of the pedicle by which the female bell is hung upon the axis of the *Agalma*.

[1] The authors state that they have never seen these "closed Hydræ" drop off, but they suggest that it "seems natural to suppose that they do separate from the parent stock" to found new communities.—*Sea-Side Studies, p. 80.*

The eggs cast into the water are then impregnated by sperm from the male bells. Previously to this event the egg is of course incapable of development, and it is an interesting fact that the male bells of one colony cannot fertilize the eggs from the same. I need not remind the reader how widespread this law is in the plant world. Two sexes are joined in the same *Agalma* colony, but self-fertilization is not possible. The egg cannot be impregnated by the male element from the same *Agalma* as that from which it arises, but is cast into the water, and there fertilized by the males from another *Agalma*. Artificial impregnation of the egg often fails because this principle has not been recognized and followed. Although there are very many known examples, where an animal has the power of casting eggs capable of development before the adult form is reached, nowhere do we find this principle in nature better illustrated than in *Agalma*. Even before the *Agalma* has doffed features called embryonic, from the fact that they are limited to the young, and are not present in the adult, the jelly fish lays eggs, which, strangely enough develop into other *Agalmata*, and eventually into the true adult form, which their parent had not attained to when they were cast. The egg floating in the water after the escape from the female bell is transparent, and has a cell contents, but with no differentiation in any part except the existence near one pole of a more transparent space containing a dot. These structures are called the germinative vesicle, and the germinative dot respectively.

The first changes which I have observed in the egg after impregnation, or contact with the male element, is the formation in the germinative vesicle of a number of radiating lines, which give to it an indistinct likeness to a wheel with radial spokes and a central hub, which is represented by the contained dot. At the same time there separates from this region of the egg two small spherical bodies similar to those cells which in the eggs of some other animals have been given the name of direction cells. The radiated appearance in the germinative vesicle, is what is known as segmentation, and is very peculiar in *Agalma*.[1]

The next important change in the development of the egg after the segmentation above described has taken place, is the disap-

[1] Of the obscure method of segmentation among Physophoridæ much remains yet unknown. The account which I have given of the peculiar radial structure in the germinative vesicle may be of something else than segmentation. See P. E. Muller, Naturhistorisk Tidsskrift, 3 R. 7 B, 1871.

pearance of the germinative vesicle altogether, leaving the egg perfectly homogeneous, and covered with short vibratile hairs or cilia, by the motion of which it is driven through the water. Intermediate changes, too technical to speak of in this account, occur, but I have omitted to mention them. Now opens a long chapter of the developmental history, which includes stage after stage, each different from its predecessor, following one another in rapid succession, all looking, although sometimes indistinctly, to the formation of a new *Agalma*. Of these stages in growth there are three which are characteristic and so distinct, that I have deemed them worthy of special names. They are of great importance in a study of the systematic position of *Agalma*, and are as follows :

1. Primitive larva or primitive medusa (Lizzia stage).
2. Athorybia stage.
3. Young resembling closely the adult, but still retaining embryonic structures, *i.e.*, embryonic tentacles, covering scales, &c.

Between the primitive larva, the Athorybia stage and the adult *Agalma*, there is very little likeness. The third stage, however, has in most particulars a very close resemblance to the adult as figured in my sketch, Fig. 1, and differs from it only in size and in certain minor details. It is indeed very difficult to decide when the adult form of *Agalma* is really reached, for it begins to lay eggs when in an immature condition, as far as adult characters are concerned.

The first change in the egg, after the peculiar process called segmentation which I have already described, is the formation of a stage in which the germinative dot and vesicle disappear. A knowledge of this fact may be of use to one studying the process of development, for unless these structures in the egg of *Agalma* do disappear, the egg will not pass into following stages. Haeckel erroneously states that the germinative dot and vesicle does not disappear in genera closely allied and perhaps identical with *Agalma*.

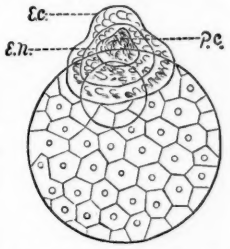

FIG. 7.—Egg of *Agalma* with apical elevation.

The next stage is the planula with the whole surface covered with cilia, which is followed by one in which is formed at one pole an elevation composed of two layers, which also becomes very thickly pigmented. The most superficial of these layers is

formed before the more profound. The former is called ectoderm; the latter, endoderm, and between them is a third which eventually becomes very thick, forming the great mass of a helmet-like structure of gelatinous character, which gives the characteristic shape to the primitive larva. This enlarged layer corresponds with that which forms the mass of the bell of an ordinary free medusa.

All these layers are formed at one pole of the egg, and gradually, as their elevation above the surface of the ovum continues, their edges grow down towards the equator of the egg. The limit of this growth is the opposite pole at the other end of a diameter opposite that from which they originated. In subsequent growth the yolk sac itself, in the genus *Agalma*, is transformed into a feeding polyp of peculiar kind. According to Haeckel this transformation does not occur in genera closely allied to that which I have considered. The modified yolk-sac may be detected in later stages of the growth of an *Agalma* by a peculiar network of bright crimson pigment spots covering one side of the polypite into which it is changed.

A continued elevation of the layers, at the pole of the egg, has left below the deeper a small cavity. This cavity is bounded by endoderm on the upper side and by the undifferentiated contents of the egg-sac on the other. The middle layer, which I have said lies between ectoderm and endoderm, increases very rapidly, and the ectoderm keeps pace with this enlargement, yet in an inverse ratio becomes relatively thinner and thinner, until it is reduced to a simple epithelium layer, in which condition it is found in the adult of all the bells, and nectocalyces of the adult *Agalma*.

At the same time that the middle layer is thus enormously increasing in size, the endoderm, which lines the primitive cavity has pushed out into this growing layer and its cavity has elongated into a tube, which at one end opens into what remains of the primitive cavity, and at the other seems to end blindly in the gelatinous substance of the apical enlargement of the embryo. The gelatinous middle layer now thickens so much that it has formed a helmet-like body, the rim of which extends down along the sides of the larva in the form of a free ring separated on all sides except at the apex of the larva from the larva itself.

It may be well, before we go farther, to point out that in this larva, which is the so called primitive larva, we can recognize all the

organs of the jelly fish, called Lizzia, one species of which, *L. octopunctata*, is found in the waters of our bays. The helmet-shaped organ of the larva of *Agalma* will be seen to represent the bell of the Lizzia, and the egg from which it has developed the proboscis. The central tube of the helmet of the young *Agalma* is the exact reproduction of the early condition of four tubes in the bell through which the nourishment of the Lizzia circulates, and which are called chymiferous vessels. Tentacles or structures corresponding with these thread-like organs, which arise from the margin of the bell of a Lizzia, do not in fact exist depending from the rim of the helmet-like cap of the primitive larva.

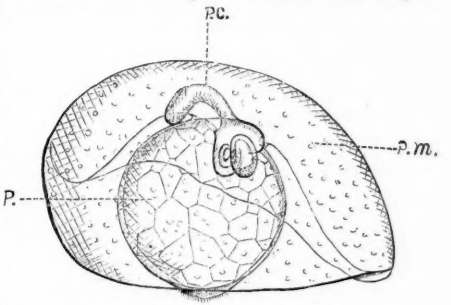

FIG. 8.—Primitive larva of *Agalma*.

The primitive larva or Lizzia stage of the young *Agalma* is well formed at the end of the fourth day after the eggs have left the female bells. Its change into the following or Athorybia stage is very rapid, and in outward appearance very radical. Before considering the details of these changes let me give names to the different parts of the primitive medusa, or Lizzia stage, in order to simplify references in the following pages.

The helmet-shaped bell, fitting over the egg from which it was formed, bears very many resemblances to a covering scale, and under that name it has generally been described. To avoid confusion, I suggest for it the name of primitive covering scale, the meaning of which designation is, I think, self-evident. The tube-like cavity in its center may be known as the primitive tube and the cavity in the eggs itself, from which this tube is differentiated, as the primitive cavity. That part of the larva which corresponds to the proboscis is designated the primitive proboscis.

The Lizzia stage of the young *Agalma* is followed by a second, which from its resemblance to a genus of Siphonophores, called Athorybia, I have called after Claus, the Athorybia larva, or Athorybia stage of *Agalma*. About the same time that the primitive medusa stage is reached, there appears as a bud from the primitive tube a small structure, which later develops into a float.

This body is not the end of the primitive tube enlarged, but is a true bud from it, and as such should be considered in all our studies of its homology.

2. ATHORYBIA STAGE OF THE YOUNG AGALMA.

As the primitive medusa grows older, the primitive covering scale is lost, either by absorption or by a rupture of the connection with the growing larva, and new buds take its place, forming a circlet of covering scales just under the float. These covering scales are different from those of an adult *Agalma*, and have their edges very finely serrated. They are in fact very similar in their structure to the covering scales of the genus Athorybia, and on that account the name of Athorybia stage, seems not inappropriate to apply to this condition of the growing *Agalma*.

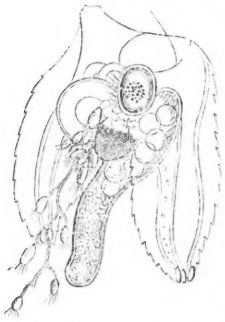

FIG. 9.—Athorybia larva of *Agalma*.

Another peculiarity of this stage is the character of the tentacles, and the knobs which hang as pendants from them. The tentacular knobs of the Athorybia stage never develop into an adult knob like Fig. 4. They are embryonic and are confined to the young larva, more especially to that stage known as the Athorybia larva. On account of their restriction to larval conditions it may be well to speak of them as the larval knobs. They are club-shaped, and from peculiar cells at the distal end there arise structures which resemble stiff hairs. (Fig. 9.)

3. LARVA WHICH RESEMBLES THE ADULT.

(PHYSOPHORA STAGE.)

The Athorybia larva has no swimming bells and no elongated axis or stem, but immediately after that stage is reached an axis begins to form at the same time that buds, producing swimming-bells, make an appearance. A circlet of covering scales of very different outline and destitute of serrated edges, replace those which characterize the Athorybia larva. A new tentacle, with tentacular pendants like the adult, also make an appearance, so that we have a stage in which both kind of pendants, embryonic and adult, are to be seen. I have called this stage of the young *Agalma* the Physophora stage, because at the very end of the

stem its cavity is enlarged, and on that enlargement hangs a circle of covering scales not unlike what exist in the genus of Siphonophores, called Physophora. The larva is now in a condition structurally not very distant from the adult. In minor details there are, as has been already pointed out, certain differences, but from this stage on the growth into the adult is direct and without the formation of provisional organs of any kind.

A description of the development from the bud of each kind of characteristic structure found on the stem of the *Agalma*, would take me into details too special for this paper. It is sufficient for our argument as to the nature of the *Agalma*, to state that each and every structure along the stem originates as a simple bud, which can at first hardly be distinguished one from the other,

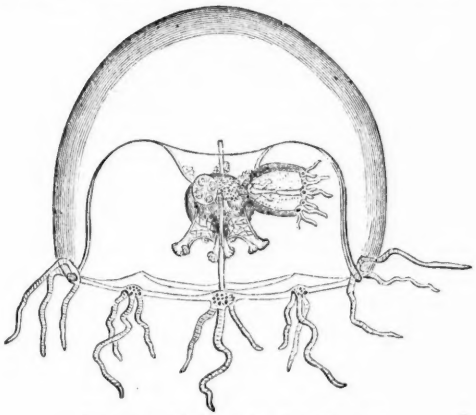

FIG. 10.—*Lizzia octopunctata* (young).

whether they form float, swimming-bell, feeding polyp or covering scale. In their earlier stages they are all alike. The details of the changes by which now a swimming-bell and now a float is formed are not necessary for my argument, and I will not consider them in this place.

I have already, in my former sketch of the anatomy of *Agalma*, made the comparison of the Siphonophore to a little medusa, called Lizzia, found in our waters. That comparison at which McCrady hinted long ago is supported by the embryology which I have just given.

In the primitive medusa, as has been shown, we find a jelly-fish with parts identical with those of a Lizzia. All the organs

are duplicated in one and the other. What are the changes of form which in subsequent growth so alter the external form as to produce in the one case a Lizzia, such as I figure (Fig. 10), and in the other an *Agalma?*

In the figure of *Lizzia octopunctata* Forbes *(grata* Alex. Agassiz), a species common in Massachusetts bay, several buds can be seen through the bell, forming on what is known as the proboscis. If these buds are closely examined, it will be found that they are young Lizziæ in different stages of growth, and if the proboscis of the largest of these buds be minutely studied, on it will be found buds of still a third generation, grandchildren of the original jelly fish. All these buds whether products of the first or second budding process, eventually break away from the place from which they first formed as buds, and swim away as jelly fishes, the form of which is not unlike the parent from which they sprung. Even before that separation takes place, the impatient young may be seen opening and shutting their bells, and swinging on their fragile stems trying to break themselves loose.

Suppose now that the proboscis of the Lizzia from which the buds formed was very much elongated into a tube. This tube then we liken to the axis of an *Agalma*, and if buds were formed along its whole length, as can be very easily imagined, the likeness would be even more striking. To be sure all the different buds in the *Agalma* are not of the same form or outline. Neither are they alike in the Lizzia. Some are very fully grown while others are in incipient stages of growth. This variety in shape could not then be an objection to the comparison which I have urged.

Each bud which forms along the stem of an *Agalma* is called by some naturalists an individual, from the fact that in early stages they resemble each other so closely, and when fully grown oftentimes certain of them bear such a close likeness to forms of Medusæ, which lead an independent life. I do not consider every bud an individual, but think that in some cases the position on the stem or other causes has so modified them that two or even more buds, as in the case of polypite, and covering scale together make one true individual. A zoöid, as defined by zoölogists, does not seem to be a fitting term to apply to these structures found along the axis of an *Agalma*, unless the term be given the broadest extension. In such a case the distinction be-

tween a zoöid and an individual does not seem very great. Through those jelly fishes called the Trachynemidæ, as Circe, there seems to be a close relationship between the hydroid Medusa, Lizzia, and the common Aurelia, Cyanea and other Discophoræ. As therefore I cannot but designate a Pelagia, also a Discophore, as an individual, I must look upon a Circe as the same, and since Lizzia and Circe are closely related, their free Medusæ are likewise morphological individuals. If this is true, and our theory of the likeness between *Agalma* and Lizzia not fanciful, is it proper to call the members of the former colony zoöids, or shall we regard them true individuals?

The solution of this problem as to the exact nature of the members of an *Agalma* colony is most difficult, and, as so many before me, I must leave this speculative part of my subject with the trite remark, that in this animal we have a condition of life where the difference between organ and individual is reduced to a minimum. It is without doubt true that much of the controversy which has been indulged in, as to the exact nature of the different components of the *Agalma*, may reduce itself to a quarrel about terms.

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THE RELATION OF APICULTURE TO SCIENCE.[1]

BY A. J. COOK.

I ONCE heard a well known professor and scientist, than whom there is no better student of American agriculture, remark, that the art of agriculture was founded almost wholly upon empiricism; and that all it had to thank science for, was that the latter explained what had already been determined by the empiric method. Whether this be true or not, the reverse is most certainly true of practical entomology. Economic entomology rests almost wholly upon science. So, too, apiculture, as practiced to-day, owes its very existence to science. Fear deters most people from bee-keeping, unless a desire to study bees, and to know more of the nature and habits of these marvels of nature, impels to that close association with bees, which practical apiculture demands.

For this reason, there is no class of men engaged in manual labor pursuits which possesses the intelligence and enthusiasm which characterize apiarists, or which practices so much that is really sci-

[1] Read before the Entomological Section of the A. A. A. of S.

entific. The successful apiarist of to-day must be able to inspect every part of his hives; must be constantly familiar with the precise condition of every colony of his bees; must be possessed of quick and accurate powers of observation. Thus we understand why science has gleaned so much from practical apiculture.

The nature of the several bees in each colony, as to sex, function and longevity, is now well known to every intelligent apiarist. The peculiar characteristics of queen, drones, and workers, and the peculiar duties of workers of different ages, are matters of daily observation.

The queen is seen to lay three or four eggs per minute, and the apiarist, by adding comb with empty cells, proves that she may lay as many as 4000 eggs per day. Aristotle was correct, then, in calling the queen the mother, and Virgil wrong in pronouncing her to be the king. Her hatred of rivals is easily shown by the certain combat, fatal to one of them, when two queens are placed together. This enmity induces swarming, as bees rarely suffer a plurality of queens in the same hive. In swarming the queen never leads, yet the special place of clustering is usually determined by the queen. Unless the queen accompanies the swarm, the latter will always return to the hive.

By clipping one wing of a virgin queen, so that flight will ever after be impossible, the bee-keeper quickly proves the correctness of the great Huber's discovery, that queens always mate on the wing. The same experiment proves the correctness of Dzierzon's more wonderful discovery, that drone bees are a result of agamic reproduction. No queen whose wing is clipped while yet a virgin, so far as I have observed, and I have tried the experiment many times, will ever lay eggs that will produce other than drone bees. It is also true that if a queen is forced to virginity for three or four weeks, she will always remain a virgin.

Upon the queen's return from her mating flight, we may observe the evidence of success, as she always if successful bears away a portion of the drone's reproductive organs, which remain attached to the queen for some hours.

It was a theory of the late Samuel Wagner, that the placing of unimpregnated eggs in the larger cells of the drone comb, and the impregnated ones, in the smaller worker cells, was simply automatic. The pressure from the smaller cell upon the queen's abdomen, forced the sperm cells from the spermatheca, as the

eggs passed by. As there would be no such pressure from the larger drone cells, the spermatozoa would not be extruded from the spermatheca. Practical bee-keepers have shown this to be untrue.

Queens have been seen to lay eggs in the still larger queen cells, which eggs are always impregnated. The queen often lays in worker cells, where the walls are but just commenced, and where there is no compression; yet such eggs are always impregnated. That the bringing of the sperm cells into connection with the germ cells, or the withholding of them, as the eggs are to produce females or males, is a matter of volition with the queen, is sustained by the muscular character of the spermatheca. It is a curious fact, that young queens, when they first commence to lay, often put several drone eggs into worker cells, though after the first day or two, they generally deposit only impregnated eggs for the first season. It seems probable, that the muscles of the seminal sack of the queen do not act efficiently till somewhat in practice.

An anomalous physiological fact is illustrated in the flight of the queen when swarming takes place. Though she may not have used her wings since her marriage flight, possibly for two or more years, yet the muscles are by no means atrophied, as shown by her rapid flight, often for several miles, *en route* to her future home.

The reason why a few impregnated eggs develop into queens, while thousands of the same produce worker bees, appears to be wholly due to quality and quantity of food. They receive much more and much richer food. The enlarged cell is necessary to a full sized queen, but not to a queen. The exceptional position of queen cells is simply for convenience, as it is not important.

Direct observation, as also her removal from the hive, shows that the only function of the queen is to lay eggs.

I have known a queen to lay with no abatement of fertility for five years, though often in one or two years she ceases to be prolific, either from her own impotency, or from a depletion of the spermatheca, in which case only drone bees are produced. Usually the worker bees arrange to supercede the queen before she becomes an exclusive drone producer.

Common observation proves that the drones are males, that they are great eaters, and that they have no function in the

economy of the hive, except the sexual function. As already explained, the drone loses a portion of his reproductive organs, in mating, which act is attended with immediate death.

Though doubt is sometimes expressed as to the origin of drones by parthenogenesis, there is no such doubt among intelligent apiarists. If the wing of the virgin queen is clipped, or the entrance to the hive so contracted that she cannot fly, or again, if she is reared when there are no drones, she will be, not sterile, but from her eggs will come only drones. Often these will be in the small cells, when the drones will be no larger than the workers. The eggs from fertile worker bees, and also from old queens, with depleted spermathecas, will likewise produce only drones. In appearance and structure these drones are every way normal. I have no doubt but that they are functionally perfect.

There is an interesting fact connected with the appearance and disappearance of drones, whose explanation seems to call for an intelligence above instinct. As the colonies become very populous in spring, the worker bees build drone comb, and rarely even tear down and replace worker with drone cells, and the queen lays the unimpregnated eggs in such cells, preparatory to rearing queens, and to swarming. If we remove a queen none but drone comb will be built. Now suppose a colony is strong and preparing to swarm, and suddenly, from lack of bloom, continuous rains or great drought, the secretion of nectar suddenly stops. Honey gathering of course ceases, brood rearing is discontinued, and, not infrequently, the bees kill all the drones, and even drag the larvæ and pupæ from the cells. As soon as the honey harvest is hopelessly cut short by the autumn frosts, the worker bees commence at once to bite and worry the drones, till the latter are driven forth to die. But if the colony be queenless, or if the queen has become superannuated, the drones will be permitted to remain in the hive all winter. The fate of the drones hangs on the prosperity of the colony. With rapid increase of bees and honey they are safe; adversity in these respects, unless caused by loss or impotency of the queen, betokens their speedy extinction.

Drones are tolerated in a strange colony, which is not generally true of either the queen or workers.

The longevity of drone bees, as we have seen, is largely dependent upon circumstances. There is good reason to believe that they may live through the entire season.

The worker bees are imperfectly developed females, which from receiving less and different food, while larvæ, are immature in their sexual development. A worker larva, less than three days from hatching, will, if given more and richer food, develop into a queen. If an apiarist allows a colony to go queenless for a long time, fertile workers are almost sure to appear, from whose eggs, however, none but drones are produced. Some apiarists suppose that such workers receive, perhaps by accident, a richer and more abundant pabulum. I have wondered if this might not verify Lamarck's idea of evolution. The bee desires eggs, and the deeply felt want induces the extra ovarian development.

The worker bees are shorter than the drones and queen, and less robust than are the drones. Their wings are small but strong, and move very rapidly in flight. When the bees are angry the rapidity is still more marked, and there is a corresponding increase of pitch to the hum.

The workers, as the name implies, do all the work of the hive, hence a reason for their better developed mandibles, with which they cut comb, remove cappings and dig pollen from the cells; their longer tongues and maxillæ, with which they extract nectar from deep tubular flowers, and the deep baskets on their posterior tibiæ and basal tarsi, which are wanting in the queen and drones, in which they carry pollen and propolis to their hives. As they protect the hives from intrusion, they need and possess a better developed sting than that of the queen, which is only used in dispatching rivals.

By the introduction of Italian bees, which differ greatly in color from the German or black bees, bee-keepers have learned that the old bees, for the most part gather the honey pollen and propolis while the young bees remain within the hive and secrete the wax, build the comb, feed the brood and cap the brood cells, though the old bees will do the work of the young ones if for any reason the natural equilibrium of the colony is destroyed.

That bees possess and use the sense of smell, is obvious to the apiarist. If he unite two colonies, they often engage in fierce combat, which only terminates when one of the parties is vanquished. By smoking, sprinkling with an essence, or otherwise giving to both the colonies the same scent previous to the union, perfect peace and harmony is secured. The same fact leads to somewhat similar precautionary measures in introducing queens.

In going to any place, bees seem to be guided by direction rather than sight. Thus if we move a hive, but for one or two feet, the bees will, for days, descend to the old position, and then turn abruptly to the hive. I have been led to notice a strange exception to this; by placing honey on a porch of one of two houses that are exactly alike, but about five rods apart, many bees were misled and swarmed about the porch on which there was no honey. The experiment was several times repeated.

Experience shows that bees will winter quite as well with pure honey or sugar syrup for food, as though they had pollen with it. They may be kept healthy at least for a time, in confinement, in summer, on a pure hydro-carbonaceous diet, and will secrete wax and make comb, with the usual activity. But pollen is a *sine qua non* to brood rearing. Probably it is also necessary for the old bees, at times of great activity. Bees also need water. Unless very active, this want seems to be met by the water of the honey; but in shipping bees they are now generally fed with candy or crystalized sugar, and unless water is added, they perish in a few days.

Nectar, as gathered from the flowers, contains much more water than does the honey. The bees leave the nectar, which is often nearly as thin as water, some time before capping, until the necessary evaporation has transpired. Bee-keepers call this the curing process. Some nectar is so thick that it is capped very soon, though frequently it remains for days, and rarely is it of such a nature that it does not thicken, and the bees refuse to cap it at all. Such nectar, usually from bark lice, etc., is unwholesome, and unfit food, even for the bees. If thin nectar is extracted, bee-keepers evaporate the moisture from it by artificial heat, as it does not preserve its quality unless rid of the superfluous water.

One of the most terrible disasters that can befall the apiarist is to become the victim of foul-brood. In this terrible disease a fungus attacks the brood, which causes it to become putrid and disgusting. It is very contagious. The disease is common in Europe, and has brought ruin and discouragement to apiarists in several of our own States. Spraying with salicylic acid has been found an efficient cure.

The enemies of bees is certainly a matter of interest to all scientists, and especially to zoölogists. Among mammals, shrews and mice are often quite destructive to bees. The king bird, *Tyrannus carolinensis*, captures worker bees, although it is

partial to drones. Toads and frogs seem to lap up bees with no inconsiderable relish, and often work quite successfully to deplete the hives.

Bees have many and formidable foes among insects. In the order Hymenoptera, a species of Xylocopa, probably *X. micans*, has been observed to kill bees in North Carolina. The cow killer, *Mutilla coccinea*, destroys bees in the States from central Illinois to Texas. It has been reported several times that ants are at times a serious foe to the honey bee. It is stated that they not only worry the bees by invading the hive, but that they sometimes kill both the queen and workers.

The only lepidopterous insect which annoys American apiarists is the bee-moth, *Galleria cereana*. And even this is no dread to the intelligent apiarist. It is found that strong colonies of bees, and no other pay, and especially if Italians, will always defend themselves against this enemy. It is only weak or queenless colonies that succumb to this foe.

Among Diptera, *Bombylius mexicanus*, is reported to enter the hives, in Texas, without resistance and lays its eggs, where the prospective larvæ will be nourished and cared for, without labor on the part of the mother fly. The family Asilidæ affords the most serious dipterous pests to the apiarist. Of these there are at least three species of Asilus, two of Mallophora, two of Promachus, two of Laphria, and two of Erax, that catch and kill bees. These predacious flies work the most serious mischief South, but are not exempt from blame even as far North as Ontario. A parasitic fly of the family Tachinidæ is destructive to bees in several of the States.

In importing bees, the bee louse, *Braula coeca*, has been introduced from Europe; but so far it promises to do little harm in our country.

Amongst Heteroptera, *Phymata erosa* is a dreaded foe of the honey bee. From its close mimicry of the flowers of many composite plants, in which it is wont to hide, it finds it easy to grasp the bees with its unique anterior legs, when it soon sucks out their life juices. *Mantis corolina* kills bees from Central Illinois to the Gulf.

Many of the Libellulidæ, chief among which is *Anax junius*, are so fierce in their onslaught on bees, that they have been termed bee-hawks. These marauders depredate in all sections of our country.

I need not speak, at this time, of the value of bees in fertilizing flowers, as that has been ably discussed by our botanical friends. That bees ever injure buckwheat or other plants, by seeking nectar from their bloom, as is sometimes claimed, is known to be erroneous by all present. That they are equally harmless to grapes and other soft-skinned fruits is not so generally granted. Personally, I have never seen a case, though I have several times gone quite a distance to see them at the request of positive individuals. In each case, the bees were found never to attack sound fruit, but only to sip from such as had burst, or been torn by other insects or by birds. While I am not positive that bees are never guilty of such wrong-doing, I do feel certain that such actions if ever true, is quite exceptional. I have lived in California in the midst of apiaries and vineyards, and I have yet to see the first case of such depravity among bees.

The two great improvements in apiculture since the Langstroth hive, and scientific knowledge gave the apiarist such perfect control over his bees, are the extractor and comb foundation, both of which are recent inventions. In both cases the thought came from Germans, but perfection in carrying it out is due to Yankee genius.

The honey extractor works on the principle of centrifugal force, and by its use honey may be thrown from the combs before it is capped over, or afterward if the cappings be first removed with a knife. By this practice the comb is used over and over again, and as a result, at least twice as much honey can be secured. Experiment proves that it takes at least twenty pounds of honey to secure one of comb, besides the time of secretion is lost, as bees are usually quiet when employed in secreting the wax-scales.

Extracting is often very necessary to furnish room for the queen, so that she may lay eggs. In times of great honey secretion, the workers so fill the cells with honey that the queen finds no place for her eggs, so brood-rearing ceases, and as the workers live only for a few weeks in the active season, depletion of the hive is rapid and sometimes is carried to a fatal extent.

When bees cease gathering, from lack of nectar secretion the queen stops laying, and all brood-rearing ceases. Nothing is found to pay the apiarist so well as to feed sparingly, whenever there is a cessation from gathering honey, and so keep his colonies strong. The extracted honey furnishes a cheap and excellent food for this purpose.

Comb foundation is made from pure bees-wax and is a perfect copy of honey comb, as just commenced by the bees, except that it is much thicker. When given to the bees, they at once accept it, thin it to the usual thickness of natural comb, and use the parings to complete the cells. This saves the time and work of wax secretion and comb building, and secures straight combs, and exclusive worker cells.

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GLACIAL PHENOMENA IN THE YELLOWSTONE PARK.[1]

BY WM. H. HOLMES.

IN common with very many of the more elevated districts of the Rocky mountains, the Park district presents a variety of glacial phenomena. In exploring the deep valleys of the higher ranges, the geologist is never surprised at encountering on all hands partially rounded masses of transparent rock. These are pretty sure to be found on most of the old flood plains of the streams and often high up the sides of the valleys. They are frequently the only remaining records of ancient glaciers which have filled the valleys at different stages of their erosion. The glaciation of rocks *in situ*, in the narrow gorges, also bears testimony to the former existence of glaciers. Loose boulders are doubtless, in many cases, carried from their original beds by the force torrents, and not infrequently reach places very far distant from their original station by a gradual creeping or sliding movement —the result of undermining or yielding of the soil beneath. It is, therefore, far from safe to conclude that wherever erratic rocks are found, glaciers have formerly existed, especially in cases where these rocks may have had their origin in surrounding highlands, or even quite distant mountains of very considerable elevation.

In a region like this, however, there is every reason to suppose that glaciers once existed on a very extensive scale. The park, with the great continental water-shed that surrounds it, forms one of the grandest masses of highland in the United States.

In early quaternary times, as now—if there have been no important changes of level in the meantime—the general level of the park district exceeded eight thousand feet, and the broad areas

[1] Extracted from the unpublished Report of the U. S. Geol. Survey of the Territories. Exploration of 1878.

of mountainous country on the west, north and east, represent a former general elevation of twelve thousand feet or more.

Glaciers exist now in the neighboring Wind River and Teton mountains at elevations much below twelve thousand feet, and in the midst of glacial times descended in immense sheets to four thousand and five thousand feet. It would, therefore, be a matter of surprise if traces of glaciers were not found here, not only in the high valleys, but upon the surfaces of the broad plateaus of the park. There is, however, a singular absence of well defined glacial moraines. The tens of thousands of granite boulders that occur on both sides of the Yellowstone valley, from Cinnabar mountain to the north base of Amethyst mountain, generally lie upon the smooth surface of the flood planes of the river, or upon low ridges of alluvial drift. The significance of this fact may be that the transporting glaciers existed in the earlier stages of the erosion of the valley, and that the morainal ridges have been destroyed by the river as it oscillated from side to side in the succeeding stages of its descent from the plateau level to its present bed. These great boulders would, in such a case, be the more durable masses of the moraines stranded on the various flood planes for want of water power to transport them.

When we come to search for the source of the granite, we are led to observe an interesting fact. The only bodies of granite rock within the limits of this valley are found either on the north side or on the bottom at no considerable elevation above the river. But the erratic masses occur to a great extent on the south side of the valley and at all elevations. In the vicinity of Mt. Evarts they reach the upper surface of the plateau more than two thousand feet above the river bed. It is evident that these masses of granite were transported to their present resting places either before the valley existed or that the ice streams were so deep as to fill the valley to the brim and thus carry and strand them. Still it is a question whether in the latter case these boulders would ever reach their positions on the south side—supposing the glaciers to follow the course of the valley—as they would have to accomplish the feat of crossing the whole width of the glacier as a boat would cross a ferry. This could really only occur in case there should be such an increase in the masses of ice descending from the highlands to the north, as to completely fill the valley, sweep across its course and overspread the broad

table-land to the south. This table-land I have named the Park plateau; it is wholly volcanic, and is separated from the base of the granite highlands on the north, by the valley of the Yellowstone proper, and by the East fork, its geologic as well as topographic continuation. It extends, with but few interruptions, one hundred miles to the south. We are here led to inquire whether or not there are evidences of former glaciers on this plateau. Such evidences do exist, but they are certainly not such as we might expect. Instead of well-defined moraines, an area dotted by erratic boulders and broad expanses of polished surfaces as in the Wind River and Teton mountains, we find only a few rocks other than those that may have been derived from the plateau itself. It should be remarked, however, in this connection, that the soft rhyolites which form the greater part of the plateau, would not retain glacial markings for any considerable length of time.

An occasional small block of granite indeed is found, and sometimes at unexpected levels, as on the slopes of the Washburn mountains many hundreds of feet above the general level of the plateau. A very few have been observed beyond Mt. Washburn, on the south side. The most remarkable example of these is a boulder resting upon the brink of the grand cañon, about a mile and a half below the great falls and nearly eighteen miles from the northern border of the plateau.

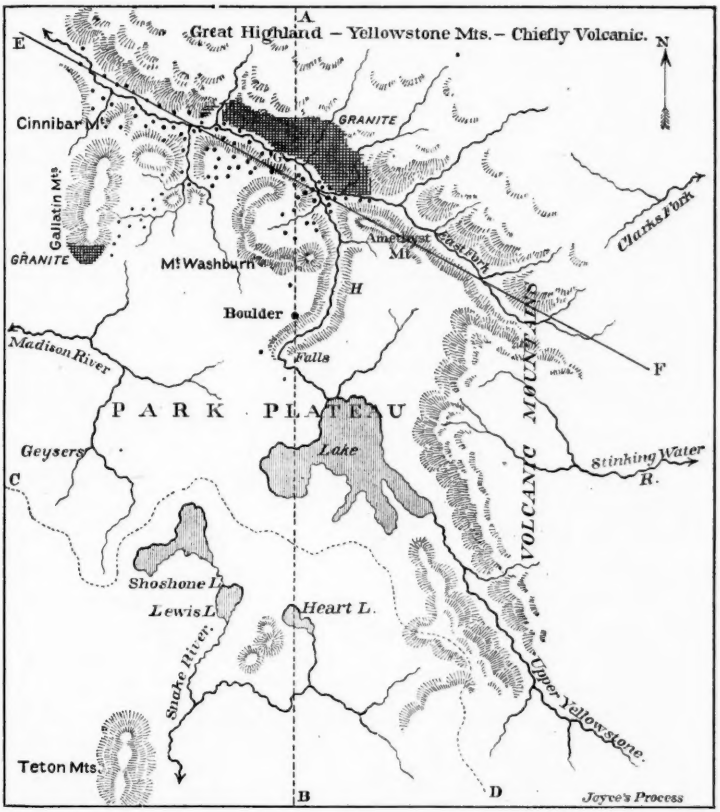
On a stormy day in December I undertook to meander the grand cañon from the falls to the base of Mt. Washburn, and during a storm of rain and sleet took shelter under the overhanging edge of a great rock in the dense timber. Considerably to my surprise I discovered it to be a very compact coarsely crystalline feldspathic granite. In shape it is somewhat rectangular, the edges for the most part sharp and unworn, the result of spawling by the heat of forest fires. In cubical dimensions it will probably exceed two thousand feet. It is within a stone's throw of the brink of the cañon and rests upon a sheet or a series of sheets of rhyolite, not less than one thousand feet in thickness, as may easily be determined by an examination of the section exposed in the cañon walls below.

In seeking the possible source of this rock we naturally turn to the south, towards the sources of the Yellowstone. The plateau along the river's course and around the lake is totally volcanic.

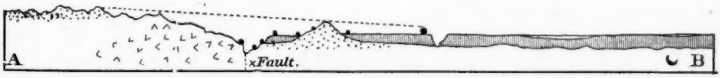
The great ranges to the east and south of the lake are not known to contain a single exposure of crystalline rock. That there are no such formations in the whole drainage of the Upper Yellowstone is established by the fact of the almost total absence of granite pebbles on the shores of the lake or in the bed of the river. The home of this wanderer must be sought elsewhere. To the north, beyond the valley of the third cañon and the East fork, lies the granite highland previously mentioned. To the north-west, beyond the valley of Gardiner river, at the southern end of the Gallatin mountains, is another exposure of granite at an elevation sufficient to have given origin to it. The distance in either case is upwards of twenty miles. From the great falls the river descends in a northerly direction until it strikes the base of the granite highland; here it unites with the East fork and turns to the west along the south base of that highland, following the line of the great displacement until it passes the granite gateway of the second cañon (see accompanying map). To reach its present position from the northern locality, the boulder must cross the course of the great valley of the East fork and the third cañon and ascend the river, as it now exists, a distance of twenty miles, avoiding on its way, by a circuitous route, the intervening Washburn range and the opposing mass of Amethyst mountain. If from the Gallatin mountains, it must first have crossed the valley of the upper Gardiner river and afterwards a considerable spur of the Washburn mountains—a journey of twenty miles south-east. Notwithstanding the fact that this pathway would, with anything like the present topography, seem to present fewer obstacles to the advance of a glacier than that from the north, I cannot regard it as at all probable that this was its course. The mass of the Gallatin mountains is not great. Glaciers originating in its short abrupt valleys would have no great longitudinal extent, and would probably advance no farther than the deepest part of the valley that lies along their immediate base.

The great ranges to the north are of sufficient extent to give birth to ice rivers of the grandest proportions. The present distribution of the erratic fragments of granite tends to strengthen the impression that they had their origin in the north. If this be admitted, it becomes at once clear that the erosion of the grand cañon has been accomplished since the close of the glacial period, or at least that a second erosion has taken place if a cañon did exist prior to the glacial epoch.

That a very profound erosion had taken place along the course of the cañon at a very early date is proved by the fact that during the rhyolitic period as well as the basaltic and andesitic, there



A-B, Section line. C-D, Ocean divide. E-F, Line of Great Fault. G, Third cañon. H, Grand cañon. The black dots indicate the position of granite boulders.



Glacial Phenomena of the Yellowstone Park.

were cañons almost as deep as the present one, into which the coulées cascaded. At one spot near the northern base of Mt. Washburn the section of a fossil river is exposed, more than

half way down the cañon wall, the bed of which has been cast in andesitic lava, and the volume of whose water discharge is recorded in pumice stone.

These events probably belong, however, to miocene and pliocene times, and the topography of this region in those periods—the course of the rivers and the configuration of the country must for the most part remain unknown.

Topographic changes of quarternary times are, however, much more easily traced. The mass of glacial ice necessary to carry the great boulder described above to its present resting place would change the whole drainage of the park. The waters of the Upper Yellowstone and of the numerous tributaries of the lake would be forced across the low continental divide to the south and become tributary to Snake river and the Pacific, or otherwise to some of the western branches of the Missouri.

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A COLLECTOR'S NOTES ON THE BREEDING OF A FEW WESTERN BIRDS.

BY E. HOLTERHOFF, JR.

THE bird fauna of the country lying east of the Mississippi river, has been for years exhaustively studied and written about by the resident naturalists scattered over its entire surface; but the great expanse of territory lying west of that river has been comparatively little studied, and offers for the naturalist the greatest attractions. Especially is this the case in those territories, where, until the past few years, the military posts of the Government, and a few trading posts, constituted the sole settlements of the white man. Now, however, the advent of a resolute mining population has opened out much new country which will steadily continue to develop, and as population pours in, there will come some eager and able to investigate and make known its treasures of natural history.

It was with great satisfaction that I found myself in Southern California, in the spring of the present year, and at the commencement of the breeding season of its birds. And although I was called away by the first of April, and unable to study any but the earliest in breeding, yet a month later I was able to continue my studies and collections in the vicinity of Tucson, A. T., and in a

still better field. And although not in the field as much as I could have desired, the results of my collections amply repaid me, and intimated how much more could be developed by continuous and extended search.

The hawks are very numerous in the vicinity of Los Angeles, Cal., and are represented by many species, the most common of which is the western red-tail hawk *(Buteo montanus)*. This large and beautiful hawk is very little different from its eastern congener, the *B. borealis*, being slightly larger and with some differences in markings. Its nests and eggs are scarcely distinguishable from those of the eastern species: the nest in situation, however, is more accessible and less concealed, owing to the scant and low growth of timber. This consists of sycamore, cottonwood, and oak trees of several varieties, and does not offer the protection of our eastern and northern forests. Another western variety of an eastern species, the western red-shouldered hawk *(Buteo elegans)*, is quite common, and several nests were observed, one in a willow tree not twenty feet from the ground, was quite thickly lined with pappus from the willow, which was likewise scattered about the nest generally. The eggs, three in number, were similar to those of the Eastern species, being of a dusky white ground color, marked with large red blotches. The brown hawk *(Buteo insignatus)*, is not rare, although not seen so often as either of the former, owing to its frequenting quiet secluded places. A pair of these birds took possession of an old last year's nest which I had examined once and found old and deserted, and, after slightly repairing the inside, and lining it with green mistletoe, proceeded to lay their eggs. Riding by the nest shortly after, I observed the bird sitting on it and secured both bird and eggs; the latter, three in number, of a faint greenish white tinge, and marked with a few large, dark red blotches around the larger end. Out of the many other varieties of hawks, some of which I could not determine, I did not succeed in finding any breeding, excepting the little sparrow hawk *(Tinnunculus sparverius)*, which is everywhere abundant, and whose eggs are familiar all over the country.

Among the owls, the great horned owl *(Bubo virginianus* var. *pacificus)*, is quite common and I found several nests rather late, and all with young birds in. The barn owl *(Strix pratincola)*, together with the long-eared owl *(Otus wilsonianus)*, I found

in great numbers on the northern slopes of the foot hills, where in the dark shades of the thick growth of live oak, they found an abode well suited to them. The long-eared owl nested in great numbers in the oak trees, building a clumsy nest of coarse sticks and twigs lined with grasses, and laid from four to six dirty white eggs. The barn owl, while it remained in these thickets during the day, resorted more commonly to the bottom lands to breed, where in the hollow trunks and branches of the sycamores, it found its favorite resting places. Its eggs, also of a dirty white color, are not much larger than those of the long-eared owl, although the bird is considerably larger. The little burrowing owl *(Athene cunicularia)* is very abundant, inhabiting the deserted holes of the California ground squirrel, with which, as with the prairie dog, it seems to live in harmony. They had not yet commenced breeding when I left the vicinity of Los Angeles, or at least I found no eggs in the several burrows which I dug up. The mottled owl *(Scops asio)* breeds here, as a friend of mine found a set of four eggs, and captured the bird on the nest, but the bird keeps close in the hollow trees and can scarcely be scared from its retreat or nest, and thus escapes observation. Later, in Arizona, I observed several times a very small owl which I was unable to identify or procure a specimen of.

One of the earliest birds to nest in the vicinity of Los Angeles, was the white-rumped Shrike *(Collyrio excubitoroides)*. It is quite abundant, and owing to the brightness of its plumage, and the absence of many of the migratory birds which had not yet returned from the South, is very noticeable. I found quite a number of nests of this bird, all placed in low trees or bushes, and compactly built of small sticks and grasses, and lined thickly with the pappus from the Baccharis, a species of Compositæ. The eggs are very similar to those of other shrikes and are well known. Another early breeder is the California jay *(Cyanocitta californica)*. This bird is also numerous and with all the traits of the blue jay, is not near as handsome a bird. It builds its nest in a thick tree or bush, and while it resembles that of the blue jay, it never has mud in its construction. The eggs, varying in number from four to five, are very handsome, being of a rich emerald green color, and marked with numerous dark brown spots, thicker around the larger end. The California sickle-bill *(Harporhynchus redivivus)*, a thrush whose liquid melody of song may favorably com-

pare with that of the mocking-bird, is a resident by no means rare in Southern California. It is, however, very shy and plunges abruptly into the nearest bushes on being approached or disturbed. It nests, after the fashion of all its family, in low trees or bushes, near the ground, and preferably in a thicket or secluded place. The only nest with eggs that I found was at Cotton, Cal., a short time after leaving Los Angeles. It was situated in a low elder tree, and was composed of coarse twigs and grasses, and lined with fine rootlets; resembling the nests of others of the Harporhynchus family, it was not so large as any of them. The three eggs, which constituted the complement, were well incubated. They were of a light pea-green color, marked quite thickly at the larger end with dark brown spots of a considerable size, and were rather elongated. Some weeks later, on the Colorado desert, at a station called Flowing Wells, I found a nest and two eggs of the LeConte's thrush *(Harporhynchus lecontei)*, a variety of the *H. redivivus*, according to Dr. Coues. It is a smaller and lighter colored bird than *H. redivivus*, and its nest and eggs are considerably different. The nest was placed in a palo verde tree and was a very bulky affair, measuring externally nine inches in depth and six in width; the hollow of the nest was fully three inches in depth. It was so awkwardly situated that much of the base of the nest had evidently been filled in to firmly support the structure. The two eggs were somewhat smaller than those of *H. redivivus*, lighter in color and marked all over with finer reddish spots, thicker at the larger end.

Campylorhynchus brunneicapillus is the long name given by scientists to a very odd little creeper wren which is peculiar to the south-western States and Territories. The cactus wren, so called from its habit of nesting in the cactus whenever available, is stationary in its habitat, keeping together in little flocks during the winter and separating early in the spring into pairs. They are very early breeders, numerous dates in February being given for the finding of nests and eggs. It was the tenth of April, however, before I succeeded in finding a nest with eggs, but shortly after I found nests containing large young ones. Their nests are worthy of notice, for they have no resemblance to the nests of any other birds in our fauna. They are shaped somewhat like a retort, and are laid on the branches or between the forks of a cactus. The body of the nest is rounded, often as large as a man's head,

and composed entirely of grasses well interwoven and lined thickly with feathers. The entrance is by a long funnel-shaped passage on one side and at the top of the nest, and varying in length from six to ten inches. The lining of feathers is very thick and is comprised of feathers of many birds. Dr. Heerman, an old time ornithologist, has said that he would often tear open the nest of a cactus wren to ascertain what birds were in the vicinity. The number of eggs in a full complement is almost invariably five; occasional nests with three or four well-incubated eggs constituting the only exceptions. The eggs are of a pale salmon color, marked so thickly and evenly with darker salmon color as to give a very rich cast to the whole egg. While the bird commonly seeks the cactus to build its nest in, sometimes when this is scarce, it will build in a mesquite or other tree, and in this case almost always at a considerable height—ten to twenty feet. I am told that this bird raises a brood as late as August, and if it does, as I have no reason to doubt, it then breeds continuously during a period of six months. In that time one pair could raise five or six broods, but it is not likely that they make a new nest as soon as one brood is fully fledged.

A very common bird from the mountains to the coast, in California, is the brown towhee *(Pipilo fuscus)*. These plainly colored finches, although pre-eminently ground birds, nest in low bushes or scrub trees, contrary to the habits of the family. A nest, found shortly before leaving Los Angeles, was placed between the forks of a prickly pear cactus, and contained four eggs of a light blue color, marked with lines and dots around the larger end, resembling the eggs of some blackbirds. The nest was composed of grasses and fibers from the bark of the cactus, and lined with horsehair. There are two other species of the same genus and somewhat resembling this bird, which I afterwards found breeding in Arizona, the Abert's finch *(Pipilo aberti)* and the canon finch *(Pipilo mesoleucus)*. They also are tree or bush builders, and there is a similarity between the nests and eggs of all three. The Abert's finch built a somewhat larger and not as neat a nest as the others, composed entirely of grasses and lined with a few horsehairs. The eggs, larger than either of the others, were of a light blue color, marked with numerous black lines and spots in a ring around the larger end, and also with a number of bright red spots. The canon finch, nesting in the same situations,

built a smaller and neater nest, composed of fibers from the dead cactus and a few fine grasses, and lined with the soft fibers. The eggs, three in number, like those of the Abert's finch, were of a light blue color and marked more universally and thickly with dark spots, thicker at the larger end.

The little house finch *(Carpodacus frontalis)* is everywhere abundant throughout Southern California and Arizona. I found its nests in all sorts of places and at all times. The eggs are very similar to those of our Eastern purple finch. The Western lark *(Sturnella neglecta)*, although everywhere abundant, escaped my notice in nesting until just as I was leaving California, when I found a nest and six nearly incubated eggs. There is no perceptible difference between the eggs and those of *S. magna.* The black flycatcher (*Sayornis nigricans*), a bird much resembling our pewee in its habits and mode of nesting, is not rare in California. They seem to be in pairs all the year round, and may raise a very early brood. The only nest I found was at Cabazon, Cal., and was plastered to the side of a house after the fashion of the barn swallow. It was composed of mud and lined with grasses, and contained four pure white eggs of delicate texture. At this same place, in some willow trees growing alongside a little stream, I found several nests of the Arkansas finch *(Chrysomitris psaltria)*, all with young birds except one, which contained four bluish-white eggs. The nest and eggs are very similar to our *C. tristis.*

After leaving Los Angeles, I proceeded by stages along the route of the Southern Pacific railroad, and with a short time to spare at different stations, found some nice things before reaching Tucson, A. T. At Colton, Cal., I first found the nest of that diminutive little bird, the least bush titmouse *(Psaltriparus minimus)*. An inhabitant of the Pacific coast country, it does not penetrate east of the mountains, but west of them is abundant the whole length of the coast. A small and plainly colored little bird, its habits confine it to the bushes, and it is not easily seen or distinguished. The first nest I found was suspended from the branches of a greasewood bush, and I at once recognized it, but thought it deserted, it looked so old. Tearing it open, however, I found it contained six small pure white eggs, partly incubated. Regretting my haste in spoiling the nest, I pursued my hunt, and was shortly rewarded by finding another nest suspended from the branches of an elder bush. I frightened the bird from the nest

and succeeded in shooting it for positive identification. The beautiful little structure was shaped like a purse, and the contracted rim was worn around two or three little shoots of the limb, the nest hanging free. It was about six inches in length and was composed of mosses, shreds of vegetable fiber, inner strips of bark and lichens, all woven into a thick, strong felt, and the bottom on which the eggs lay was softened with willow down and feathers. The entrance to this remarkable structure was a small hole, not an inch in diameter, placed at the very top, and concealed by some leaves of the bush skillfully woven over it. The eggs, six in number in each nest, were unlike those of the rest of the family in being pure spotless white, without gloss. They were very delicate and not over a-half an inch in length. Another minute little bird, but of another family, is the black-headed gnat-catcher *(Polioptila melanura)*. I first saw this gnat-catcher, to recognize it, at Indio, on the Colorado desert. There were a great many gnat-catchers around Los Angeles, but I did not notice them closely or shoot any, taking them all to be the blue-gray species. At Indio, however, in the clumps of mesquite trees, which first appear here, I saw numbers of these little birds and then recognized them as the black-headed species. There is a species of mistletoe which grows thickly in nearly every mesquite tree, and in it, after close search and watching, a pair of the birds. I found their nest woven to the branches in the heart of the parasitic plant. It was a delicate little structure, composed of various vegetable fibers, a down from some plant and fine strips of bark, compactly matted together and lined with the same downy material. The nests were not as handsome as those of the blue-gray gnat-catcher, but were very neat and elegant. The first nest found contained three young birds and one egg, but further search discovered another nest with four eggs in, slightly incubated. The eggs, about the size of those of the blue-gray species, were of a lighter color and more thickly marked with black and reddish spots. Later, in Arizona, I noticed the remaining species of gnat-catcher peculiar to our fauna, the Arizona or lead-colored gnat-catcher *(Polioptila plumbea)*. It was too late at the time to find either eggs or young ones in the nest, as all that I saw were in little families—the parents and young brood.

At Indio I likewise first noticed a bird which became more common and familiar in Arizona, viz., the black-crested fly-catcher

(Phænopepla nitens). All along the line of railroad through the Colorado desert, where the mesquite grows at all—and this is at intervals only—I saw little flocks of these birds sitting on the tops of the trees, and ever and anon darting through the air in pursuit of insects. During my hunt for the gnat-catcher's nest I started one of these birds from a thick clump of mistletoe, and on close examination discovered its nest in it. Climbing the thorny mesquite with many a scratch, I at length succeeded in getting a footing where I could look in the mistletoe and examine the nest. It contained two eggs, and was of a very peculiar construction for a nest built in a tree, and looked more like the nests of such birds as build in a hole in a tree, as the ash-throated fly-catcher. It was small and composed of small twigs, grasses, vegetable fibers and down, loosely matted together, and with a small cavity pressed out in it. It was in the heart of the mistletoe and was not fastened to its branches, but laid on them and kept secure by the thick growth of the plant. The two eggs, considerably advanced in incubation, were very peculiar—of a slate-colored body ground, they were thickly marked all over with black spots, forming a dark ring around the center of the egg, which gradually shaded off at the larger end. They somewhat resemble the eggs of the cedar bird. The bird itself I did not recognize until I had shot and examined it. A peculiarity in its plumage, noticeable in flight, is the white color of the inner webs of the primaries; this, looking from beneath the bird while on the wing, gives a transparent look to half of the wings. Two eggs seem to be a small number for a full set, but they were nearly incubated and the cavity of the nest did not look as if it could contain more, so it may be the full number. Although I saw numbers of these birds at Tucson, yet it was later and I found no more nests.

The Arkansas fly-catcher *(Tyrannus verticalis)*—the Western bee-bird—is everywhere common. At Tucson I first found the nest and eggs, which cannot be distinguished from those of our *T. carolinensis.* The long-tailed chat *(Icteria longicauda)* is fully as common as our yellow-breasted chat, and is, in fact, too much like it to form a distinct species. Its nests, and eggs too, are identical with the yellow-breasted species. The little yellow warbler *(D. æstiva)* is abundant; and I was surprised to observe several pairs of redbirds *(Cardinalis virginianus)* around Tucson,

and to find the nest of one pair. This seems to me an extreme western limit for the bird. The little Bell's vireo *(Vireo belli)* enlivened the solitude of the chaparral with its warble, short and sweet. I found numbers of its little pensile nests, like those of the warbling vireo *(Vireo gilvus)*, and all within a few feet of the ground. The set of eggs, three in number, are very like those of *V. gilvus*, but smaller and more pointed. Among the troupials, the hooded troupial *(Icterus cucullatus)* and the Bullock's troupial *(Icterus bullockii)* are the most common around Tucson, and the only ones whose nests I found. The hooded troupial builds a pensile nest composed entirely of grasses, and lined at the bottom with a few bunches of down. It is not unlike the nest of our orchard troupial. The eggs, three in number in every nest I found, are unlike those of the other troupials I have seen, but are marked with light and dark brown spots, chiefly around the larger end, and are of a bluish-white body color. The nests were all very thin, but firmly woven. A nest of the Bullock's troupial which I found a few miles out of Tucson, is a very beautiful and unique structure. It is composed entirely of different colored twine and yarn, horsehair and bits of paper, and so well and thickly is the horsehair woven in, that the nest is very stiff and substantial, and scarcely compressible. A bit of newspaper woven in the bottom of the nest, bears the words, "special attention," and is very appropriate. This nest contained five eggs, evidently a large set. They were of the size and shape of those of the Baltimore bird, but of a smoke color and thickly marked all over with lines and blotches, the lines forming a thick net-work around the larger end. The Carolina dove *(Zenaidura carolinensis)* is very numerous; and the white-winged dove *(Melopelia leucoptera)* was not uncommon, although not so abundant as back in the mountains where it breeds. I had the good fortune to find a nest of the little ground dove *(Chamæpelia passerina)*. I had seen several of these beautiful little doves, but did not know where to look for their nests, and only discovered this one by accident. It was situated between the horizontal forks of a limb about twenty feet from the ground, and consisted merely of a slight platform of grasses laid on the forks. It contained two small white eggs pointed at either end and marked inside with the lateral transparent lines peculiar to the eggs of the dove family when fresh. This situation of the nest was contrary to my preconceived ideas

of it; the little dove, while nowhere common, is found throughout our southern borders. The short-legged pewee *(Contopus richardsonii)* does not seem to be rare throughout this southern country, but I only succeeded in finding one nest. It was saddled to a horizontal limb after the fashion of our wood pewee, and was composed of small twigs and grasses fastened together and to the limb with saliva, and was lined with finer grasses. The three eggs, well advanced in incubation, were of the size and shape of those of the wood pewee, and were of the same body color, but marked with some very large and some small reddish-brown blotches, chiefly around the middle of the egg. I also found a set of four eggs of another fly-catcher, the ash-throated fly-catcher *(Myiarchus mexicanus)*, the same day that I found the nest of the short-legged pewee. It was in a hole in a willow tree, and consisted merely of a bunch of matted hair and wool. The eggs are so like those of the great crested fly-catcher as to be almost indistinguishable. On another hunt shortly before leaving Tucson, I found nests and eggs of two more thrushes peculiar to this border fauna, viz: the crissal thrush *(Harporhynchus crissalis)* and the curve-billed thrush *(H. curvirostris)*. The former nest was situated in a low oak tree, a few feet from the ground, and was not large for the size of the bird. It was composed of coarse and small sticks, and was lined with fibers; the eggs, two in number and well incubated, were of the size and color of the robin's egg. The curve-billed thrush had nested in a tall cactus, and its nest was much larger and deeper than that of the *H. crissalis;* the cavity, in fact, was nearly four inches deep. The three eggs, about the size of the former, were of a light-green color, marked all over with fine red spots. Several other nests found the same day, but empty, were likewise in the cactus. A set of two eggs of the Western night-hawk *(Chordeiles henryi)*, found somewhat later, did not differ materially from the eggs of the *C. popetue*, and were laid on the bare ground beneath a bush. The birds are everywhere abundant.

I will now describe the nest and eggs of another minute species of the titmouse family, the verdin or yellow-headed titmouse *(Paroides flaviceps)*. I first observed the nests of these little birds on the Colorado desert, where, out of many I examined, only one was occupied, and that by fully fledged young. At Tucson, however, I succeeded in finding two nests of the second laying, with

respectively three and four eggs in. Their nests are wonderful pieces of bird architecture, being often half the size of a man's head, and the builder scarce larger than a humming bird! They were each built at the end of a horizontal limb, and firmly woven around it; composed of thorny twigs well interwoven with grasses, vegetable fibers and mosses, and the interior compactly lined with down and feathers, not only on the bottom but all around the inner circumference of the nest. The entrances to these unique structures were at first invisible to me, so small and well concealed were they; placed at the top or on one side, they were either immediately under the supporting limb or the fabric of the nest above the hole was pulled down so as to conceal its presence. The little birds are very shy, and seldom show themselves except when they have young. The eggs in both nests were well incubated and I am convinced were all the birds were going to lay in that, their second nest. Five constitutes the full number in the first set, as proved by the five young birds I found on the desert. The nests, although generally situated within a few feet of the ground, were sometimes placed as high as twenty feet, and some, too, were placed between the forks of a cactus. The eggs are of a light-green color, varying in intensity in different specimens, and were marked with numerous fleckings of a golden-brown, more numerous around the larger end; they were of a scant half inch in length, and rather pointed.

Another bird peculiar to this fauna is the chapparal cock or road-runner *(Geococcyx californianus)*. This bird is wide-spread throughout the southern borders of our country, and its eggs are not rare in collections; but as to their number and the situation of the nest, there are contrary assertions. I have heard it said that two constituted the full set, and that one was laid some time before the other, after the occasional manner of the cuckoo; also that the nest was laid on the ground in the midst of a clump of cactus. I have seen a good many nests and heard from collectors in the localities of many more, and while occasionally placed in the cactus and rarely on the ground, the majority of the nests were in thick bushes; and in one case, as witnessed by myself, the nest was built on a thick horizontal mesquite limb, fully twelve feet from the ground. The nest, too, instead of being rude and imperfect, was rather neatly built of coarse sticks, and with the considerable cavity lined with grasses. The eggs in this nest

—pure white and about the size of a pigeon's egg—were five in number; two were considerably advanced in incubation, one was pipped and two were infertile. In another nest, found by a friend and authentic, were seven eggs, none so far incubated as to render blowing them difficult, and some infertile. I scarce know what inference to draw from these instances of a large number of eggs, but do not think the bird would raise so large a brood. Also the presence of infertile eggs in these nests where there were large numbers of eggs, seems to contradict the idea that they raise such a large brood. But why did they lay so many eggs? Perhaps some observer has explained, but I have never seen the explanation.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Nomenclature is an essential part of language. Owing to the sense limitations under which we exist, objects must have names. So also must general concepts derived from objects have names. The one essential of naming is, of course, that distinct things shall have distinct names; and the second essential is, that each object or concept shall have but one name. These necessities become more and more urgent, as the number of known objects becomes greater. In order that each object and concept shall have but one name, cultivators of the natural sciences have determined to use that name which was first proposed with such a definition as shall enable them to ascertain the application intended by its author. All subsequent names are thus necessarily rejected as waste, to be forgotten as soon as possible. Moreover, names created for objects or concepts which are not defined, are rejected, as not being really proposed; for a name which is not applied to a stated object or concept, is quite as little nomenclature as an object or concept without a name. A name is, in fact, a short substitute for a definition, and where no definition[1] exists, there can be no name. Thus the rule of priority has become the *modus operandi* of nomenclature, and its only possible law.

Besides this practical necessity, an ethical element enters the question. The good opinion of the world is as much property as money and real estate. In fact, *it is* money and real estate.

[1] It is evident that definitions must often, in the early stages of a subject, be imperfect. But even a bad definition conforms to the necessary rule.

It is just that every man should be valued at his true worth, and should have the opportunity of securing a just valuation at the hands of his cotemporaries. Mental products are prime elements in this valuation; so are labors undergone, and sacrifices submitted to. Intellectual products are unquestionably property, and he who attempts to pass off the results of other men's labors as his own, is as much a thief as he who picks a pocket, or burglariously enters a house. Now when nomenclature represents original ideas, the two conditions of equity and convenience are fulfilled. From this we draw the conclusion, that it is well for producers of ideas to create nomenclature, and that non-producers should avoid it.

The habit of giving credit to others for their ideas is a concomitant of increased numbers and near contact of producers, like any other evidence of civilization. The habit of justice is maintained by the mutual pressure of interests; and knowledge of each other's work is readily obtained through easy intercommunication. Right is a natural element which develops under agitation, and perishes by neglect. All interests contribute to it. No one desires to be thought to plagiarize; but where credit for the ideas of others is not given, plagiarism may be suspected. Hence in some cases, pride, if not benevolence, will prompt to justice. It is indeed true that the same ideas occur independently to different men in different places. But it will always be difficult in these days of wide and ready distribution, for the later producer to know or show how much he may not have been influenced by his predecessor in the field.

The comparative isolation of some of the centers of scientific production in the United States, and the small number of persons so occupied in many of these localities, renders us especially liable to the faults implied in the above remarks, and this in spite of the fact that, for our population, we hold as a nation, a very respectable position in the world of scientific work and thought. Whether it be from the lack of international competition on this continent or not, national pride does not yet seem to be sufficient to induce many Americans to credit their countrymen with their productions, but will attach them too often to foreign names, or will reproduce them, as though absolutely new. A striking instance of this regardlessness occurs to us in the quadruple nomenclature of the geological formations of the center of this continent. After Dr. Hayden, supplemented by Mr. King, had named and classified the geological horizons of the West, Major Powell, in order to have "a new slate," proceeds to ignore the greater part of this work, and names an extensive series of them over again. Soon after, Mr. King, assuming the rôle of a palæogeographer, names the great inland lakes which successively occupied tracts of our continent. Of course the sediments of these lakes had already received names, which are of necessity applicable to the bodies of water which deposited

them. Such use is universal in Europe, and the proposition of the new nomenclature by Mr. King, is scarcely more defensible than the proceedings of Powell. But the conclusion was not yet reached. Professor Marsh coolly putting aside all this work of his predecessors, *re-names the entire series* from the period of the beginning of vertebrate life to the present time. He selects names from characteristic genera of fossils, in itself a good basis of nomenclature, but, in this case, utterly uncalled for.

We may soon look back on this stage of our scientific development as presenting some characteristics of the beginning of the century in Europe. The necessities of progress will doubtless early correct any tendency to neglect or ignore just claims wherever found.

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RECENT LITERATURE.

ZITTELL'S HAND-BOOK OF PALÆONTOLOGY.[1]—While the recent death of Professor Schimper was a great loss to science, it must also prove a serious blow to Professor Zittell, who was aided by the learned fossil botanist in the preparation of the botanical portion of his Palæontology. The part before us is much thinner than the first, and although no intimation is given by the publishers, we suppose that this is the last part which will appear from the pen of Professor Schimper, and that some one else will carry on the botanical part of the work.

This second part completes the ferns and Rhizocarpeæ, and contains the account of the Calamarieæ, Lycopodiaceæ, and the Phanerogameæ, including the Cycadeaceæ, the part completing the account of this first order of Cycads. It will thus be seen that the author before his death had elaborated the larger tree-like Cryptogams of the coal period, so that this part is of special interest and value to students, and especially teachers. The account of Calamites and its allies is preceded by a general account of the living Equisetaceæ, and figures with which may be advantageously compared those illustrating the restoration of Calamites; so that we obtain a tolerably clear notion of the appearance of these gigantic fossil horsetails of the coal period. Under the head of Calamocladus, the branches and whorled leaves of the Calamites, originally described under the name of Asterophyllites, are figured and described. Antennularia is next described; then Asterophyllum as restricted by Schimper, and other forms, as well as details of fructification which are doubtfully regarded as parts of different species of Calamites, but allowed to stand under various generic names.

The giant club-mosses, Lepidodendron, Sigillaria, etc., are then

[1] *Handbuch der Palæontology*, unter mitwirkung von W. PH. SCHIMPER, herausgegeben von KARL A. ZITTELL. II. Band II. Lieferung. Mit 49 original-holzschnitten. München und Leipzig, 1880. 8vo, pp. 153–232.

treated in the same comparative and suggestive way, with excellent figures, showing the restoration of these forms from Zittel's work, "Aus der Urzeit," together with figures of allied forms, and drawings illustrating their histology. The table on page 209, giving a comparative sketch of the morphological and anatomical characteristics of Sigillaria, Lepidodendron, Isoëtes and the Cycadeæ, summarizes these points in a graphic manner.

It should be borne in mind that this work is the result of extensive personal research by the authors in collecting materials expressly for the results here given, and is not merely a compilation; thus the treatise is fresh, authentic, and therefore indispensable to those only familiar with the general popular works of Nicholson, and the older works of Owen, Pictet, and the palæontological portions of Lyell, Dana and other geological authors.

GÜNTHER'S INTRODUCTION TO THE STUDY OF FISHES.[1]—No living man has so large an acquaintance with the species of recent fishes as Dr. Günther, and his works on Ichthyology are a *sine qua non* of every zoölogist's library. The author of these is not more distinguished for his wide learning in this and other fields, than for his conscientiousness in certain points of nomenclature. While sustaining the law of priority in specific and generic names, he has always done so with the condition that those names should represent something in order to become available. For *nomina nuda* he has had no respect, and he has been one of the most stalwart of those who have doubtless prevented the natural sciences from being buried beneath a load of nomenclatorial rubbish. The naturalists of the future will scarcely know the debt they owe to those who have taken this logical position, and will hardly credit the assertion that there was once a period in the history of their science when persons sought to be esteemed scientific, by the mere creation and proposal of names. Dr. Günther and his co-workers have had to take care, that the popular recognition usually accorded to name-makers, shall not affect the virtue of the true scientist; and that the coin of their science shall consist of golden ideas, and not of empty words.

The portion of this work devoted to the anatomy of fishes covers 192 pages, and is very full and well illustrated. It forms the best manual of the subject in existence. A short chapter on the geological distribution of fishes follows, which is of little value. The section treating of the geographical and hypsometrical distribution is extensive and valuable. Here will be found an account of the deep-sea fishes, etc., a most interesting subject, to which Dr. Günther has contributed more than all other ichthyologists combined. The systematic portion occupies the remainder of the book. Here can be found extensive reference to

[1] An Introduction to the Study of Fishes, by Albert Günther, Keeper of the Zoölogical Department of the British Museum. 8vo. Edinburgh, Adam and Charles Black. 1880. pp. 720.

most of the leading genera of fishes, with diagnoses of the families and higher divisions as understood by Dr. Günther, with many good illustrations. While this part of the work will always be most valuable to the student, it remains to point out two radical defects. In the first place, the systematic classification is anything but a just reflection of the structural likenesses and unlikenesses found in nature, combining as it does all the faults of the older authors, some of which are crystallized into a new error of the learned author's own creation. We allude to his subclass of *Palæichthyes*, which is a triumph of systematic *gaucherie*. The second deficiency of which we complain, is the wonderful ignorance of North American Ichthyology displayed in the book. It is scarcely necessary to enter into detailed criticism of this part of the subject. We summarize by saying that the book has no value whatever as representing North American Ichthyology, and can only be read by the student here, as a systematic text-book, with reference to exotic species and genera.

BRÜHL'S ZOÖTOMY FOR STUDENTS.[1]—We have often wanted some work giving sketches, with each part identified, of the anatomy of common types, especially of vertebrates. It will be difficult for the student to find in any single book, not excepting Owen's anatomy of the vertebrate animal, good, detailed figures of the common salamanders, lizards, birds or mammals. We therefore subscribed to Brühl's Zoötomy, and have found the parts as issued so useful for the purpose stated, that we unhesitatingly recommend it to teachers as the cheapest and fullest atlas of comparative anatomy with which we are acquainted. Twenty parts have been published, of which five have appeared during the past year. They comprise among other illustrations the osteology and visceral anatomy of the fowl and other birds, different fishes, reptiles and the osteology and brains of the apes, the latter given with sufficient fullness. The five parts issued lately illustrate the osteology of the Lepidosiren, Protopterus, Ceratodus, Chimæra, Callorhynchus, *Rana pipiens*, and of different turtles, the details being abundant, and evidently well drawn from nature. Very few of the figures are copied from other authors, and appear to be reliable, though we have not compared them with original preparations. The author is Professor of Zoötomy in the University of Vienna. Further information is given in the title below.

INGERSOLL'S FRIENDS WORTH KNOWING.[2]—Boys and girls are, in this little book, treated to glimpses of snails, birds, wild mice, and then taken out to the plains and shown by word and pictures the

[1] *Zoötomie aller Thierklassen für Lernende*, nach Autopsien, skizzert von CARL B. BRUHL. Illustrirt durch Zweihundert Tafeln, mit nahe 4000, von Verfasser meist nach der natur gezeichneten und sammtlich von ihm mit dem diamant in Stein radirten Figuren, Atlas in 50 Lieferungen zu 4 Tafeln. Wien, 1879, 8vo. Alfred Hölder, New York, B. Westermann & Co.

[2] *Friends Worth Knowing*. Glimpses of American Natural History. By ERNEST INGERSOLL. Illustrated. New York, 1881, 12mo, pp. 258.

haunts and habits of the buffalo. Such pleasant reading as this, illustrated as the text is by uniformly attractive wood-cuts, most of them of much artistic excellence, is just what is wanted for young people. Particularly adapted to this end are the chapters entitled, "In a snailery," "Wild mice," "Our winter birds," and "First comers." "An ornithological lecture" will, we think, hold closely the attention of young readers and is written in the author's happiest vein. The effect of the book will be not only to interest the reader in the story so pleasantly told, but when next summer he meets with snails, frightens the wild mouse from its nest, or hears the notes of the thrush or song-sparrow, or sees the yellow birds gather about the thistle, he will not only recall the ornithological lecture he or she has read, but desire to learn for himself or herself more about the beautiful, attractive forms enlivening the woodlands and meadows, or peopling the shrubbery or orchards near the house.

GENNADIOS ON PHYLLOXERA.[1]—This is a small volume of seventy-eight pages in 12mo, divided in eleven chapters, of which the first nine review the origin and natural history of the insect and the remedies employed in other countries for the prevention of its ravages. The tenth chapter points out the great danger to Greece from importation of infected vines and the insufficiency of the existing laws on the subject. There is nothing new in the book, it being compiled from the writings of Planchon, Lichtenstein and Riley; the latter's figures, which have already done good service abroad, being rather poorly reproduced. It is the first work on the subject in modern Greek that has come to our notice.

WOOD'S INSECTS ABROAD.[2]—The title of this book is somewhat misleading in a work published here, as many of the insects figured and described are common American species. This is explained by the fact that the book first made its appearance in 1874, in London, and treats of insects which are exotic from that standpoint. It is, however, an interesting book, and the author, through having access to the collections of the British Museum, has been enabled to present figures of many of the rare and curious treasures there preserved. The work is so pleasing in appearance and so entertaining withal that we regret to feel obliged to mention the presence of many typographical errors and to put our readers on their guard against placing too much confidence in some of the statements contained in the text.

RECENT BOOKS AND PAMPHLETS.—Orange Insects. By Wm. H. Ashmead. 8vo, pp. 78, pls. 4. Jacksonville, 1880. From the author.

Notice of recent additions to the marine invertebrata of the northeastern coast of

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[1] *The Destructive Phylloxera.* By P. GENNADIOS. Athens, Greece, 1879.

[2] *Insects Abroad.* A companion volume to "Insects at Home." Being a popular account of foreign insects, their structure, habits and transformations. By the Rev. J. G. WOOD, M.A., F.R.S., etc. New York, George Routledge & Sons. 8vo, pp. xii, 780, with 520 figures.

America, with descriptions of new genera and species and critical remarks on others. Part II. Mollusca, with notes on Annelids, Echinodermata, etc., collected by the U. S. Fish Commission. Part III. Catalogue of Mollusca recently added to the fauna of Southern New England. By A. E. Verrill. Washington, D. C. (From the Proceedings of the U. S. National Museum, III. Printed Dec., 1880, and Jan., 1881.) 8vo, pp. 335–410.

Descriptions of new species of Crinoids from the Kaskaskia group of the Sub-carboniferous, pp. 7, pl. 1.—

Notes on some new or little known North American Limnæidæ, pp. 8.—

On the Geographical Distribution of certain fresh-water Mollusks of North America, and the probable cause of their variation, pp. 8.—

Some notes on American Land Shells, pp. 8.—

Remarks on the Trenton Limestone of Kentucky, pp. 17, pl. 1.—

Descriptions of Crinoids from the Upper Sub-carboniferous of Pulaski county, Kentucky, pp. 7, pl. 1.—

Remarks on the genus Pterotocrinus, Lyon and Casseday, pp. 6, pl. 1.—

Descriptions of new Crinoids from the Cincinnati group of the Lower Silurian and the Sub-carboniferous of Kentucky, pp. 9, pl. 1. By A. G. Wetherby. (All ext. from Journ. Cincinnati Soc. Nat. Hist., 1879.) From the author.

Description of five new species of Silurian fossils, and remarks upon an undetermined form. By S. A. Miller, pp. 4, pl. 1. (Ext. from Journ. Cin. Soc. Nat. Hist., 1881.) From the author.

James Smithson and his Bequest. By Wm. J. Rhees. (Smith. Misc. Coll.) pp. 159. From the institution.

Early discoveries of the Hawaiian islands. By Henry A. Peirce and Chas. Wolcott Brooks. 8vo, pp. 8. San Francisco, 1880.

Ein geologischer Spaziergang durch Neu-Mexico und Arizona. Von Dr. Oscar Loew. pp. 42-51. From the author.

Proneomenia Sluiteri gen. et sp. n., eine neue archaische Molluskenform aus dem Eismeere. Von Dr. A. A. W. Hubrecht. (Sep.—Abd. aus dem "Zool. Anzeiger," 1880, No. 70.) From the author.

Discoveries of Minerals in Western North Carolina. By John T. Humphreys. (Read before Buffalo Acad. of Nat. Sci., June 11, 1880.) pp. 4. From the author.

Chesapeake Zoölogical Laboratory. Report of the third year. Advanced sheets.

Contribution a l'Etude Anatomique des Némertines. (Assoc. Franc. pour l'Avanc. des Sci.) pp. 48, pl. 1.—

Note sur une nouvelle espèce d'Elasmobranche hypotrème, le Cephaloptera Rochebrunei, pp. 3.—

Note sur la ponte du Pleurodèle de Waltl observée à la Ménagerie des Reptiles du Muséum d'Histoire naturelle, pp. 18. (Ext. du Bull. de la Soc. Phil. de Paris, 1880.)—

Sur la disposition des vertèbres cervicales chez les Chéloniens, pp. 4.—

Sur le développement des spinules dans les écailles du Gobius niger (Linné), pp 4.

Sur la ponte des Amblystomes au Muséum d'Histoire naturelle, pp. 3.—

Sur l'oeuf d'un poisson du groupe des Squales Stogostoma tigrinum, Broussonnet. 4to, pp. 2. All by M. Leon Vaillant. From the author.

Catalogue des Mammiféres Vivants et Fossiles. Par Dr. E.-L. Trouessart. (Ext. Bull. Soc. d'Etudes Scientif. d'Angers, 1880.) 8vo, pp. 48.

Revision du Genre Ecureuil (Sciurus). By Dr. E.-L. Trouessart. (Ext. Le Naturaliste, Oct., 1880.) pp. 10. From the author.

The anatomy, histology and embryology of Limulus polyphemus. By A. S. Packard, Jr. (Anniv. Mem. Boston Soc.) 4to, pp. 45, pls. 7, 1880. From the author.

Die Fossile Flora der Polarländer. Von Dr. Oswald Heer. Beiträge zur Miocenen Flora von Nord-Canada. 4to, pp. 17, pl. 3. Zurich, 1880. From the author.

Untersuchung über Fossile Hölzer aus der arctischen Zone. Von C. Schrœter. 4to, pp. 38, pls. 3. From the author.

Fifteenth Annual Report of the Colonial Museum and Laboratory, pp. 55. New Zealand, 1880. From the museum.

An Introduction to the Study of Fishes. By A. C. L. G. Gunther. 8vo, pp. 720. Edinburgh, 1880.

First Annual Report of the United States Geological Survey. By Clarence King, Director. pp. 62, 1 map. Washington, 1880. From the survey.

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Prontuario Filoxérico. Por Mariono de la Paz Graells. Madrid, 1879. 8vo, pp. 61, 2 plates. From the author.

Glances at Forestry in France in 1660 and 1880. By the Rev. J. C. Brown, LL.D. (Reprinted from the Journ. of Forestry and Estates Management, Oct. and Dec., 1879, and March, 1880). 8vo, pp. 24.

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Paltostoma torrentium. Eine Mücke mit zwiegestaltigen Weibchen. Von Dr. Fritz Müller. (Aus Kosmos, 1880.) 8vo, pp. 6. From Dr. Hermann Müller.

On some new and little known species of Tineidæ. By Thomas, Lord Walsingham. (From Proc. Zool. Soc., 1880, No. VI.) 8vo, pp. 17, 2 plates. From the author.

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Description of a new species of Limenitis. By W. H. Edwards. (From Can. Ent., Vol. XII, 1880.) 8vo, pp. 6. From the author.

New species of Tineina. By V. T. Chambers. (From Journ. Cincinnati Soc. Nat. Hist., Jan., 1881.) 8vo, pp. 8. From the author.

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Die Variabilität der Alpenblumen. Von Dr. Hermann Müller. (Aus Kosmos, IV Jahrgang, Heft 6, 1880.) 8vo, pp. 15. From the author.

GENERAL NOTES.

BOTANY.[1]

VARIATIONS IN THE GROWTH OF VIRGINIA CREEPER AND HICKORY.—It is well known that no two plants ever grow exactly alike, though these variations are often very slight. Two instances have come under my observation which have interested me very much, though they may be familiar enough to botanists. The first relates to our beautiful indigenous climbing shrub, the Virginia Creeper (*Ampelopsis quinquefolia*), several of which I have transplanted from the neighboring forest to the grounds about my residence. Some of these specimens are very free growers, climbing a dozen feet during a season, having joints three to four or five inches long, and large widely expanded leaves; the tendrils in these are very long and similar to those of the wild grape. Others have very different habits of growth; the joints are quite short, not more than one to two inches long, and the growth of the whole plant is very slow as compared with the first-mentioned variety. The tendrils, too, are very short. In some instances the stems send out aerial roots which burrow into the bark of the supporting tree, after the manner of the Poison Ivy (*Rhus toxicodendron*). The long-jointed free-grower never sends out these aerial roots, but depends for its support upon its tendrils which soon become dry and hard, and as tough as little wires.

The other instance refers to our common shellbark hickory (*Carya alba*). In the spring some of the trees may be seen with bursting buds and even expanding leaves while the buds of other trees standing close at hand are dormant and remain so for many days. In autumn these differences are also quite as marked; the leaves on some of the trees ripen and shrivel up even some days before any frosts, turning to a dark gray or slate color. Upon other trees the leaves continue green until the first frosts; they then turn yellow, with something of the same beautiful tints of the hard maple, and remain so until the heavier frosts completely dissipate their golden glories.—*Chas. Aldrich, Webster City, Iowa.*

THE COMPOSITÆ—Dr. Gray, in his last "Contributions to North American Botany," issued September, 1880, from the Proc. Am. Acad. Arts and Sciences, takes a considerable space to speak of "some of the results already reached" in the elaboration of the Compositæ for the forthcoming "Synoptical Flora of North America." As the portion of that work in which this order will be included cannot be published for some time, it may be well to sketch the more important of these results. Under the genus Venonia, the species *V. altissima* of Nuttall, long considered to be a variety of *V. fasciculata*, is restored to full specific rank. Elliott's name, *Eupatorium parviflorum*, gives way to Hooker's *E.*

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

ambiguum. The genus Aplopappus is greatly extended, including the old genera Prionopsis, Eriocarpum, Pyrrocoma, Homopappus, Sideranthus, Isopappus, Stenotus, Ericameria and Macronema. The five species of Aphanostephus and the seventeen species of Townsendia are briefly characterized, and a systematic synopsis is given in each case. In discussing the genus Erigeron the author says: "It can be limited only by taking into account a combination of characters, and insisting here upon one, and there upon another." *Aster graminifolius*, of Gray's Manual, is hereafter to be known as *Erigeron hyssopifolius. Erigeron vernum* is likewise changed to *E. nudicaulis.* The genus Aster is accepted in the wide extent assigned it by Bentham and Hooker in the Genera Plantarum. The revision of this genus is not yet completed, but enough has been done to indicate that there will be but little change made in it as we have known it in Dr. Gray's works heretofore. The remainder of the order is still to be revised.

The Sensitiveness of the Root-tip of the Seedling.—We believe that there is no structure in plants more wonderful, as far as its functions are concerned, than the tip of the radicle. If the tip be lightly pressed or burnt or cut, it transmits an influence to the upper adjoining part, causing it to bend away from the affected side; and what is still more surprising, the tip can distinguish between a slightly harder and a softer object by which it is simultaneously pressed on opposite sides. If, however, the radicle is pressed by a similar object a little above the tip, the pressed part does not transmit any influence to the more distant parts, but bends abruptly towards the object. If the tip perceives the air to be moister on one side than the other, it likewise transmits an influence to the upper adjoining part, which bends toward the source of moisture. When the tip is excited by light, the adjoining part bends from the light; but when excited by gravitation, the same part bends towards the center of gravity.—*Darwin's "The Power of Movement in Plants."*

Influence of Light on the Respiration of Seeds.—Planchon read a paper before the Paris Academy of Sciences, at its meeting on Nov. 22d, detailing experiments upon this subject. The experiments were made on the castor-oil plant and the bean (Phaseolus). As in previous experiments, a good deal more oxygen was observed in light than in darkness. The castor-oil seeds exhale slightly more CO_2 in darkness than in light, but the opposite was the case with the seed of the bean. In darkness the ratio of CO_2 to O was for the bean at least one-third superior to that for the castor-oil plant, but prolongation of the experiment tends to bring the relation equal to unity, whatever the original value. For a given quantity of oxygen absorbed, the seed placed in darkness exhales more CO_2 than that kept in light. While in light there is always less CO_2 exhaled than oxygen absorbed, the

contrary occurs in darkness. These facts explain the transformation of legumin into asparagin.—*Nature.*

Botanical Notes.—In recent numbers of *Nuovo Giornale Botanico Italiano*, Caldesi has been publishing a catalogue of the plants of Fænza and vicinity. It is fully annotated and contains many references and synonyms. There are many names in the list which are familiar to even local botanists in this country, as witness the following: *Asclepias cornuti, Calystegia sepium, Scrophularia nodosa, Veronica anagallis, V. officinalis, Brunella vulgaris, Typha latifolia, T. angustifolia, Juncus effusus, J. bufonius, Eleocharis palustris, Phragmites communis, Poa pratensis, P. compressa, Equisetum arvense, E. palustre, Adiantum capillus-veneris, Pteris aquilina, Polypodium vulgare*, etc. Among the weeds are the following familiar names: *Panicum crus-galli, P. sanguinale, P. glabrum, Setaria glauca, S. viridis, Urtica dioica, Amarantus retroflexus, Chenopodium album, Verbascum thapsus*, etc. Many plants which with us are cultivated for their flowers, or for other purposes, find a place in this catalogue as wild or naturalized species, *e. g., Euphorbia cyparissias, Iris germanica, Colchicum autumnale, Hyacinthus orientalis, Ornithogalum umbellatum.* A new species of Orobanche *(O. pelargonii)*, is described; it is parasitic upon *Pelargonium inquinans.* The glumaceous plants are very unequally divided between the sedges and grasses, there being but twenty-one of the former, while of the latter there are no less than ninety-eight.——A new Alga is described and figured in the November number of the same journal by Borzì. It is regarded as the type of a new genus, Hauckia, related to Cosmocladium. The cells, which are two and two, are in the ends or sides of hyaline erect or curved stalks. Each cell by fission produces two daughter cells, and the latter develop hyaline stalks, thus giving rise to a repeatedly bifurcating mass. Macro and microzoöspores are also produced by the successive division of certain cells into two, four and eight parts, each provided with two vibrating cilia. No conjugation has been observed; on the contrary, both forms of zoöspores were seen to germinate. The species is named *Hauckia insularis.*——According to a correspondent of the *Gardener's Monthly, Caladium esculentum* has escaped from cultivation in some portions of Texas, and run wild.——E. W. Greene describes several new species of plants from New Mexico in the January *Botanical Gazette.*——In the same journal J. Schenck records his observations upon seventeen chestnut trees in Wabash county, Ill., which were planted many years ago by the early settlers. Where the trees are in groups of two or more they have invariably been fruitful, but whenever they are isolated they as a rule produce nothing but empty burs, indicating that the flowers need to be cross-fertilized *from tree to tree.*——In recently excavating a dock at Bombay, India, a forest bed was found composed of 382 trees, of which no less than 223

were in a standing posture. The largest tree was forty-six feet long and four feet and a half in circumference. The trees were generally found in a dark loamy soil composed of the disintegrated underlying rocks at a depth varying from low-water mark, to sixteen feet below low water.——It is encouraging to notice the improved facilities for botanical study and teaching in our colleges. At Michigan Agricultural College, a building 46 by 66 feet, and two-stories in height was erected in 1879, for the department of botany. The large lecture-room, 44 by 48 feet, is provided with tables for laboratory uses also. A large room on the second floor is designed for the herbarium and cabinet. At the Iowa Agricultural College new and more commodious rooms were provided for the botanical department by the erection of North Hall, in 1880. A large lecture-room is supplemented by a laboratory adjacent to it. The latter is constructed with north and east windows for microscopic work. A third room of ample size is set apart for the herbarium and cabinet.——Ten new species of Carices are described in the recently published second volume of the "Botany of California," by Wm. Boott, who contributed the article on Carex.——M. E. Jones in an article on the wild fruits of Utah, in Case's *Botanical Index*, mentions fourteen species; among these is a curious wild peach which grows in the sand and on lava beds. A wild gooseberry, *Ribes divaricatum*, var. *irriguum*, and a raspberry, *Rubus leucodermis*, would probably be hardy in the Eastern States; their fruits are described as delicious.

ZOÖLOGY.

Dredgings in the Bay of Biscay.—The following are some of the more important results to which M. A. Milne Edwards directs attention. The Crustaceæ were, he says, extremely interesting; not one of the specimens dredged is also littoral in habitat, and it seems as though there were two faunæ placed one above the other, and not mixing. He forms a new genus, Scyramathia to contain *Amathia carpenteri* and *Scyra umbonata*; a crab with phosphorescent eyes was found at various depths between 700 m. and 1300 m. *(Geryon tridens)*; this has been already seen in the Norwegian seas. *Munida tenuimana*, with large and phosphorescent eyes was not rare. *Gnathophausia zœa*, which has only as yet been collected by the *Challenger* (off the Azores and near Brazil) was also met with.

Most of the Mollusca belong to the deep-sea fauna of the North Atlantic and of the Arctic seas. Among the Mediterranean forms, there were some which as yet have only been found in the fossil state. The similarity of the deep-sea fauna at different latitudes is very strikingly shown by this collection. Pteropoda were taken from all depths; indications of Heteropoda were not absent. A short list of the more important Mollusca obtained is given by M. Milne Edwards in a foot note.

Chætopod worms were abundant at all the stations; a species of the remarkable Chætoderma was also taken; two or three genera of Gephyrea were met with, and several of the forms had a resemblance to the Arctic species.

A new species of Edwardsia (or Hyanthus), a beautiful red Adamsia, a large Bunodes, and a new species of Flabellum represent the most striking Zoantharia; the Alcyonaria are reported to be very remarkable, and among them was a specimen of the rare Umbellularia.

The Echinodermata appear to form the most valuable part of the collection; there is a new species of Phormosoma, which is to be distinguished from *P. placenta* by the ornamentation of the plates, and by its large spines on the oral surface, *Pourtalesia jeffreysii*. Two new and remarkable Spatangoids make up the chief Echinid gains. The Asterida were all interesting and rare, but above all we have to note the capture of *Brisinga coronata*, which was taken at several stations. Among the Ophiurids, which were abundant, there was found one which, not described, is said to be probably the representative of an absolutely new type. There are some new and fine species of Holothurioida. Among the Crinoids we find only two examples of an Antedon, allied to *A. sarsii* of the Northern seas. Hyalonema, Holtenia, Farrea, &c., were among the siliceous sponges.

Large specimens of *Orbitolites tenuissima* and a magnificent series of arenaceous forms are to be noted among the Foraminifera.

In some cases the dredge descended to 3000 metres, and in addition to the zoölogical collections, there have been made observations of very considerable importance on the hydrographical relations of the sea-bottom of this region.

Fauna of the Luray and Newmarket Caves, Virginia.—Last June I visited these caves in order to compare their fauna with that of Weyer's cave, situated farther south in the Shenandoah valley, which I had examined in 1874, with excellent results, having found between fifteen and twenty species of Arthropods, where no life had before been known to exist.

Newmarket cave, situated about three miles south of Newmarket, was first visited, and a hasty examination revealed the following forms:

Spirostrephon copei Pack. Several specimens prove to be exactly like those from Weyer's cave; individuals from the two caves (as well as from Luray cave) only differing from those of Mammoth cave, Ky., in having shorter hairs.

Linyphia. Webs of a small spider, probably *L. weyeri* Emerton, were common on the stalactites, but the spiders themselves were not detected. A small, long, narrow mite also occurred, and what is probably a new species and genus of false scorpions; it was blind, and quite different from Mammoth cave specimens of *Chthonius packardi* Hagen.

Among insects a single cricket (*Ceuthophilus maculatus* Harris) occurred not far from the entrance, and a beetle with eyes (Cryptophagus sp. indet.) which had probably been carried in by the men at work on the stairways and walks; also two small flies, while the true cavern fly which we have found in caves in Kentucky, Indiana and Utah was common; we refer to *Blepharoptera defessa* Ostensacken. Of Thysanura, two species occurred; a pale whitish-red Smythurus, with pale reddish eyes, and faded whitish specimens of *Tomocerus plumbeus* (Linn.) of the same color and appearance as those collected by us in the Carter caves, Kentucky. The body was nearly white, the antennæ darker, the eyes black.

The Luray caves, in Luray valley, were less populous in the parts fitted up for visitors, owing undoubtedly to the recent walks and stairways built by the proprietors. Spiders were numerous, however, all belonging to one species, *Linyphia weyeri* Emerton; they differed only from the type specimens in having rather smaller eyes. *Spirostrephon copei* was less common than in the Newmarket cave. The fauna of these caves was essentially like that of Weyer's cave. The writer would add that he is collecting materials and intends soon to publish a monographic account of the cave fauna of the United States, in the reports of the Kentucky Geological Survey, under whose auspices most of the material has been collected; and would be grateful for the loan of specimens.—*A. S. Packard, Jr.*

A Rare Fish in Illinois.—A specimen of Chologaster in the collection of the Illinois State Laboratory of Natural History, was obtained by Mr. F. S. Earle, of Cobden, Illinois, in August, 1878, from a spring at the foot of a bluff, in Western Union county, in the southern part of Illinois.

The description of *Chologaster cornutus* Agassiz, was based on three specimens from South Carolina, and that of *C. agassizii* Putnam, on one from Tennessee;—these four specimens being apparently all that were known at the time of the publication of Mr. F. W. Putnam's synopsis of Heteropygii, in 1871.

The Illinois specimen differs materially from the others, but as it is intermediate in several particulars between the two described species, and as specific descriptions drawn from so small a number of individuals must have a very uncertain value, I will give an account of this specimen prepared by comparison with the descriptions of Putnam's synopsis, without attempting to decide whether it belongs to a new species or whether it unites the two previously proposed. Head in body, without tail, 3½ times; the eye is above and well behind maxillaries and is contained about six times in head; the pectoral fin reaches half way to the dorsal; the color is precisely as in *cornutus*, except that the middle stripe, dark on the head, is decidedly *paler* than the ground color on the body, the change being abrupt at the opercular margin. The

caudal fin is dark-brown, with several rows of white specks or blotches running across the rays. The anterior part of the dorsal is similar in color, but paler. Total length a trifle over an inch. A scale from the region mentioned by Mr. Putnam, is similar to that of Agassizii, but shows five or six concentric lines and three radiating furrows.

This specimen thus agrees with *C. cornutus* in position of eye and plan of markings; with *C. agassizii* in length of pectorals and structure of scales; is intermediate in length of head, and agrees with neither in the color of the caudal and dorsal fins and the tint of the middle band.—*S. A. Forbes, Normal, Ill., Jan.* 3, 1881.

THE JAPANESE LAP-DOG.—This species of *Canidæ* was characterized in the Proceedings of the Philadelphia Academy for 1879 (July), under the name of *Dysodus pravus*, and the diagnosis was based on four skulls and one skeleton. In the NATURALIST, for 1879, p. 655, appeared notes on three living specimens examined by the writer in San Francisco, which confirmed the characters previously ascribed to the genus and species. Subsequently I had the opportunity of examining eight additional specimens in San Francisco, of which three were born there, and two certainly and others are probably, Japanese born. The characters of these are as follows:

No. 1. Premolars $\frac{3}{3}$, molars $\frac{1}{2}$; first premolar a minute cusp; two years old; Japanese.
No. 2. Premolars $\frac{3}{3}$; first and second superior minute.
No. 3. Premolars $\frac{4}{4}$; first and second superior minute cusps; first inferior do.; nine months old; American born.
Nos. 4 and 5. Exactly like No. 3.
No. 6. Premolars $\frac{3}{3}$; an old dog from Japan.
No. 7. Premolars $\frac{3}{3}$; young; daughter of No. 6.
No. 8. One-half poodle; premolars $\frac{3}{3}$; molars $\frac{1}{2}$; four and a half years old.

From the above it can be seen that the absence of the first inferior premolar is constant, as is also, I may add, the absence of the last inferior true molar. In only three specimens was the first superior premolar present, and then as a cusp-like rudiment; and these are young dogs American born. The tooth is doubtless shed before maturity. Finally, even the poodle mixture did not restore the two lost inferior molars; and two superior molars are also missing, as in the typical *Dysodus pravus*. In all, the superior incisor teeth were present. Thus, though this species shows a remarkable tendency to shed the molar teeth with age, its normal dentition, when perfectly preserved, differs materially from that of the genus *Canis*.

This species has some marked peculiarities of habits. It does not appear to possess the senses of sight or smell in the same degree as the species of *Canis*. It cannot follow its master through a crowded street, and is readily lost, even on open ground where opportunities for sight are good. As house dogs they are cleanly, and intelligent in certain directions. They do

not learn tricks easily, but seem to understand the disposition and wishes of their master very readily. They are often very vivacious and energetic, and not at all indisposed to use their canine and flesh teeth on persons whom they do not especially regard. —*E. D. Cope.*

THE EPIDEMIC AMONG MARINE FISHES.—In the year 1878 the pages of *Forest and Stream*, as also the Proceedings of the National Museum, contained notices of a remarkable mortality among the fishes and marine animals of the Gulf of Mexico, the quantity of fish perishing being something truly enormous. This year the same phenomenon is repeated and the Florida papers contain many notices on the subject.

It is considered a matter of so much importance that the National Board of Health has detailed Doctor Ginteras to visit the region and make a thorough investigation in regard to it.

Among the various communications that have reached the Smithsonian Institution, I inclose one of the most detailed, from an extremely intelligent observer, a resident on the west coast of Florida. At present the cause of the evil is unknown, but a careful comparison of the data, supplemented by the special investigations of the Board of Health, may enable us to solve the problem. The occasion is a very serious one to the fishermen, and indeed to the people of the Gulf coast generally, as a vast amount of animal life, cast in a putrifying condition on the shores, must be a source of injury to the public health.

It is desirable that any observations of facts connected with this phenomenon should be published.

SPENCER F. BAIRD, *Commissioner.*

Statement of Mrs. Charles Hoy, of Little Manatee: "The fish began dying here about the first of November. About 8 o'clock on the evening of October 28, or thereabout, I was sitting on my front gallery, the air being perfectly still, and the bay calm, when I heard a heavy splashing of the water in the direction of Gadsden point. This continued for a few minutes, and was immediately followed by a roaring sound, such as might be made by the wheels of a side-wheel steamer near at hand, though the noise seemed to be several miles away. This continued for about a quarter of an hour, as near as I could guess, when it suddenly ceased. Some twenty-five or thirty minutes afterward, heavy swells began to come up the river, such as come in during a heavy blow from the north-west. These continued for a long time, gradually becoming lighter until I went to bed. In three days the fish began to come up the river dead and dying. I caught several mullet that were standing upright in the water sick, and each had three black spots on the back, which gradually faded away. I opened the fish, and could see nothing the matter with them. The flesh was natural and firm, and the gills were normal.

"In regard to oysters I have had a rather rough experience, and can with certainty say that they are poisonous. A few days after the fish began dying, I had a quart of fine oysters for dinner. I had a lady visitor on that day, but she did not like oysters, and ate none. My daughter and I ate heartily of them, and after dinner I took my gun and went out to a pond to shoot some ducks. I took a colored woman (my cook) along, and before I had gotten half way I began to feel weak, and a mist came before my eyes. I kept on, however, to the pond, and when I reached it, I was so blind I could not see the ducks, although the water was covered with them. With the assistance of the colored woman, I got home, when I found my daughter similarly affected, and unable to walk. Neither Mrs. Simms, the visitor, nor my cook were affected, which makes me know it was the oysters. The sickness and loss of vision gradually left us after drinking a cup of strong coffee. I am confident the death of the fish is caused by the discharge of poisonous gases from the bottom of the sea."—*Forest and Stream.*

CARACAS (Venezuela), November 12, 1880.

THE LAC INSECT.—In addition to Mr. J. M. Stillman's article on "The origin of the Lac," (AMER. NAT., Nov. 1880, p. 782-787). I may be allowed to say that H. L. Carter published a rather full life-history of the Lac insect in the *Annals and Magazine of Natural History*, 1861. There exists also a special work, by J. E. O'Conor, under the title "Lac; production, manufacture and trade," a revised edition of which was printed in Calcutta in 1876, 8vo, pp. 83. It contains Carter's article in the appendix. Both confirm of course Mr. Stillman's observation that the lac is a secretion of the insect, and O'Conor mentions thirty-five trees on which it has been found. The best lac is said to be found on the *Butea frondosa*, *Ficus religiosa* and *Schleichera trijuga*.

I think Messrs. Trübner & Co., 57 and 59 Ludgate Hill, London, can furnish O'Conor's book, which is one of the official publications of the Indian government. In the number for September, 1880 (page 669) of the AMERICAN NATURALIST, my article on the fertilization of *Cobæa penduliflora* (published in *Nature*, June 17, 1880), is mentioned; but with the curious addition, that it "confirms Bonnier's statement that the nectar is of no direct use to the plant." Now Bonnier, as is well known, holds just the opposite opinion, whilst I certainly gave the case of the *Cobæa* as a relevant proof against the view he has lately tried to defend in the botanical part of the *Annales des Sciences Naturelles.—A. Ernst.*

DEEP-WATER FAUNA OF THE SWISS LAKES.—Dr. Asper gives a brief account of his investigations into the fauna of eleven of the Swiss lakes.

That of the Lake of Zurich would appear to be very rich. The Mollusca are represented by various genera, and those delicate Cyclads, the Pisidia, are always present. The larvæ of Diptera were

also numerous. Living in small tubes formed from the slime, they are either colorless or of an intense yellow or red color; they chiefly belong to the genera Chironomus and Tanypus. Acarida were nowhere completely absent. Vermes were richly represented, and chiefly by species of Lumbriculus and Sœnuris. Of the latter genus great quantities were observed. There was also a colorless Hydra. In the Lake of Luzerne seventy specimens of what appears to be *Asellus forelii* were taken at one drédging. Here, again, Lumbriculids and Dipterous larvæ were very abundant. In the Lake of Sils (Engadine), to omit many points of interest in other lakes, the Hydroids appear to be especially remarkable. A new species is described and figured by the author under the name of *Hydra rhœtica*. Of a bright red color, and often as much as 1½ cm. in size, it gives indications of forming buds which remain permanently attached to it, and so give rise to a colony. The male and female individuals can be easily distinguished. The fauna of this lake was very rich in individuals, though comparatively poor in species.—*Jour. R. Microscopic Society.*

The Poison Apparatus of Spiders.—M. Jules MacLeod has recently published in the Belgian Archives de Biologie, the results of his studies on this subject. He finds that each of the venomous glands of spiders is formed of a pyriform sac, the walls of which, provided with a muscular layer, are lined within with an epithelium, the cavity of which serves as a reservoir of the poisonous fluid. From the anterior part of this sac proceeds a canal which opens at the end of the cheliceres, or jaws. The wall of this canal contains the same parts as the wall of the sac, but the muscular layer is there, however, either much less developed or absent. The secretory cells are cylindrical, arranged in a single layer. These cells present a different aspect according to their state of repose or activity; they pass from the state of ordinary cylindrical cells (repose?) to that of cup-shaped cells (activity?) by a series of states of passage. In certain species there are only cup-shaped cells (Tegenaria), of which the cup, much elongated, plays the rôle of excretory canal.

This last form approaches the typical unicellular glands; consequently the glands whose cells presents this disposition are, properly speaking, compound glands (Tegenaria).

Deep Dredgings in the Lake of Tiberias.—The invertebrata obtained by M. Lortet in these dredgings include ten species of Mollusca, of which three are new to science. These are named by M. Locard, *Unio lorteti, U. pietri, U. maris galilæi.* The other species are *Unio terminalis* and *tigridis, Cyrena fluminalis, Neritina jordani, Melania tuberculata, Melanopsis præmorsa* and *costata.* The three latter shells give the fauna a marine appearance; and it is to be considered as a transition fauna between salt and fresh water, the lake having probably been originally salt, and subsequently altered by the passage of the Jordan waters through it. Near

the shore were found a small shrimp, and the crab, *Telphusa fluviatilis*. A very fine volcanic mud from the greatest depths contained diatoms, foraminifera, &c. No alga was brought up.

The Unio shells at the depth of 250 metres were curiously softened and resembled in condition the fossils of some of the Tertiary strata of the middle of France; this is probably chiefly due to pressure.

Fresh-Water Microscopic Organisms.—Prof. Maggi has published a catalogue of the Rotifera of Volconia, containing fourteen genera and eighteen species. He also gives a list of the fresh-water Rhizopoda of Lombardy, and has come to the conclusion that *Amphizonella flava* is not identical with *Pseudochlamys patella*, but that it is a developmental stage of some unknown form. He has investigated the plastids found in ciliated Infusoria, and especially those which are found in the nuclei of the Oxytricha. When these organisms are treated with a two per cent. solution of bichromate of potash, dark granulations are to be observed in the parenchyma of the body, and a black reticulum is also to be made out in the nuclei.

Zoological Notes.—The classification of the order of Discomedusæ (Discophora), of which the common Aurelia is the type, has been discussed by Haeckel in a preliminary way in the Proceedings of the Society of Medicine and Science of Jena. He divides the group into three sub-orders. He regards as the stem or ancestral genus of the order, Ephyra, a form similar to the larval Ephyra (Ephyrula) through which most of the species of the group pass. It will be seen from this that Haeckel does not regard the Trachynemidæ or the Lucernariæ as forming sub-orders of the Discophora, but independent orders. The discovery of a large number of new forms has led him to propose this new classification of the order.——Some points in the structure of the herring are discussed by Professor Moebius in the reports of the commission for the scientific exploration of the German seas, comprising figures illustrating the external and internal anatomy of this fish, and its crustaceous food, as well as the appearance of the fish at different ages; and a comparison of the herring with the spratt. He also gives a figure of a young flounder, and notes on the food of fishes and their mode of reproduction.——An elaborate work by Dr. R. Latzel, favorably noticed in *Nature*, on the Myriopods of Austria, is being issued in parts at Vienna; the first part comprises the Chilopoda; we notice that the author adopts Mr. Ryder's new order Symphyla for the synthetic form Scolopendrella.——Professor Huxley lately read a paper before the Zoölogical Society of London, on the application of the laws of evolution to the arrangement of the vertebrates and more particularly of the mammalia.——In a paper read by M. Viallanes, before the French Academy, on the sensitive nerve-termination in the skin of some insects, especially the larvæ of the common

fly (Musca) and Eristalis, he finds under the hypodermis an extremely rich plexus of ganglionic cells, connected on one hand with the chief nerve-centers, and on the other with sensitive terminal nerve-branches.——In a paper read at the same meeting by M. Jourdain, on the sensorial cylinders of the internal antenna of crustaceans, he states that while these have undoubtedly the characters of an organ of sense, they cannot be those of smell. ——Mr. W. H. Ballou, in the *Chicago Field*, gives an account of the fisheries of eels in the Oswego river, New York, and a good account of the habits of the fish.——Mr. B. B. Redding of the California Fish Commission, recently read an article on the propagation of fishes before the Academy of Sciences of that State. He dwelt especially on the enormous fertility of fishes as an indication that the sources of supply of human food were only beginning to be appreciated, and that the limit of human population as set down by the Malthusians is as remote as it ever was. ——M. Bocourt of the Commission Scientifique de la Mexique, has recently investigated the structure of the scales of the Scincoid and other lizards with fish-like scales. He finds the former to be perforated by canals which divide the scales into numerous areas. The similar scales of *Tretioscincus*, *Gymnophthalmus* and allies from tropical America are homogeneous in structure.

ENTOMOLOGY.[1]

NOTES ON THE GRAPE PHYLLOXERA AND ON LAWS TO PREVENT ITS INTRODUCTION.—I have received the following letter from a well-known grape grower of St. Louis, Mo., who is largely engaged in the exportation to France and other countries of American grape-vine cuttings, and as it touches a question of deep general, even international, interest, I will make it the text for brief comment.

"* * * On page 3 of your *American Entomologist*, you urge the grape-growers of California not yet afflicted with Phylloxera to exercise 'the utmost vigilance to prevent the introduction into their own localities of infested vines or cuttings.' This last word, to me at least is unsatisfactory. Why should you support that erroneous prejudice? Is it not true that in winter, when cuttings are made and shipped, it is impossible to find a live Phylloxera on them, or any eggs of this insect? The winter-egg, if it exists at all, does not exist on one year old wood, certainly not here nor in Southern France. Ask Aimé Champin; ask Leenhardt, Robin, Planchon, even; they all looked for it in vain just as you did yourself. * * * But while Spain, Italy, Hungary work to get the prohibition of the importation of cuttings repealed, as necessary to their salvation and free from any danger of importing the destructive insect, such a word from you may frustrate their endeavors. ISIDOR BUSH."

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

The ravages of what has now come to be more generally called *the* Phylloxera, though the term should always be qualified, since there are many other species besides that which attacks the grape-vine, have attracted so much attention in foreign countries and caused so much fear in those countries not yet invaded by it, that the most stringent laws have been enacted to prevent such invasion. Some of these laws are injurious and unnecessary in so far as they prohibit the importation of all living plants, and at Cape Town, more particularly, they have been carried out with such zeal, that a cargo of potatoes arriving from New Zealand was recently destroyed for fear that the pest might be imported therein. A great deal of controversy has grown out of this stringent legislation, and Dr. Maxime Cornu has lately submitted a report, in which, while confessing that *Phylloxera vastatrix* is confined to the grape-vine and can flourish on no other plant, he yet recommends the following of the example set by Algeria, which is to forbid the introduction of all vegetable products whatever except those absolutely required for consumption.

I have been too busily engaged during the last few years with other injurious insects to give very much attention to the grape Phylloxera in this country; yet I have made continuous observations which confirm all that I have in past years written on the subject, and from which I do not hesitate to declare that it is going beyond the bounds of reason to prohibit the importation of anything more than grape vines or grape cuttings from countries or districts where the grape Phylloxera is known to occur.

The life history of this interesting insect may be thus briefly stated: Starting from a stem-mother, it multiplies agamically through an indefinite number of generations, either in galls on the leaf or in cavities or on swellings on the roots. Its spread is naturally slow in the unwinged condition, whether on the surface or beneath the ground. But winged, agamic females are produced during the late summer and autumn months, and these are the true migrants of the species and disperse and spread from vineyard to vineyard through the atmosphere. They lay some half-dozen eggs only, in such situations as afford shade and moisture, and from these come the only true males and females, which are mouthless, feed not, and are born simply to procreate, the female laying, either below or above ground, a single, and the only directly impregnated egg, which has been termed the winter egg, and which in the spring following gives birth to the stem-mother which may either found a colony in a gall on the leaf, or upon the root—the latter being the more common habit.

The prohibition of other products than grape vines is based upon the supposed possibility of winged females settling thereon and depositing the few eggs which give birth to the true males and females, which last produce the "winter egg." Now the

experiments which I made in 1875 (recorded in the Transaction of the St. Louis Academy of Science, October, 1875), and which were the first recorded of their kind, show that the eggs from the winged females are most often laid in or on the ground near the base of the vine, and that they are so delicate as to require specially favorable conditions of moisture and temperature to enable them to hatch. I do not hesitate to express my conviction that when deposited on anything else than the lower, tomentose surface of the living leaf of the grape vine, where they can receive moisture by endosmosis, or in the crevices or irregularities of earth, that receives from dew or other sources a due amount of moisture, they will infallibly perish. But even supposing that these eggs could hatch, and the resulting female should lay the impregnated egg upon any other living plant, and that this egg should in due time give birth to the stem-mother, she would inevitably perish without issue for want of appropriate food; while to suppose that all these operations could go on upon any other product or substance than living plants, or upon the dry parts of plants, is to exhibit crass ignorance of the peculiar conditions necessary to the perpetuation of the species at these particular stages. With the utmost care in endeavoring to supply the natural conditions, I have failed nine times in ten to obtain the sexual individuals, and still more frequently to get the impregnated egg, and such has been the experience of others in Europe. The danger of introducing this insect upon anything else than the grape vine, where a voyage has to be made in the tropics, is yet more remote, as even supposing the "winter egg" could be produced it would prematurely hatch on the voyage.

The only way, therefore, in which Phylloxera can be conveyed from one country to another widely separated therefrom, is upon grape vines, and here we come to the question raised by Mr. Bush. My recommendation to use certain resisting American vines as stocks on which to graft the more susceptible European vine has resulted in an immense traffic between this country and Europe in American cuttings, and nurserymen engaged in this business, however unbiased they may desire to be, naturally lean toward that side of the question which furthers their own interest. The insect may be carried on the roots of vines during the winter, either in the dormant larva state or in the "winter egg" state, and while later researches, here by myself and abroad by others, have confirmed my previous experience in this country, published five years ago, as to the rarity of the "winter egg" on the canes above ground, and the more recent observations would seem to indicate that wherever it is thus found above ground it is produced rather from the gall-inhabiting type than from the more dangerous root-inhabiting type, yet the fact that this "winter egg" does occur upon almost any part of the plant above ground, and more particularly under the loose bark of the two-year-old cane,

renders it quite possible that the insect may be carried upon cuttings in this "winter egg" state, and fully justifies the prohibition of the introduction of such, as well as of rooted plants, from any country where the insect is known to occur. Indeed, considering the rarity of shipment of rooted vines, I strongly believe that the insect was originally introduced into Europe from America in the "winter egg" state upon cuttings. I would say, therefore, to those countries desirous of defending themselves from this scourge, that all danger is removed when vines and all parts of vines from infested countries are kept out. With such prohibition, all requirements are met and all legislation that goes beyond this must necessarily be hurtful to general industry; while the prohibition of traffic in American vines in countries where the grape Phylloxera is known to already occur can have no useful end and may be detrimental.

That the rarity with which the impregnated egg is found above ground greatly reduces the chances of Phylloxera introduction by cuttings is true, but in a country desiring protection from such a scourge, the remotest chance should not be risked. Mr. Bush is wrong in supposing that this egg may not occur on one year cane. I have found it upon such, and it may even occur upon the dried leaf where, in all probability, it is destined to perish.

While, therefore, I believe that the laws cannot be too stringent in preventing the introduction and use of grape vines in any living condition into a non-infected from an infected country, it is equally true that there is no danger in the mere passage through such a country of such vines or cuttings. These are necessarily boxed, and can only be safely and properly shipped during the cold or non-growing season, when the egg is dormant, so that there is a practical impossibility in the introduction of the insect by the mere passage, whether of vines or cuttings.—*C. V. Riley.*

Cecropia Cocoons punctured by the Hairy Woodpecker.—One of the most interesting as well as difficult problems in entomology, is the relation which the cocoon sustains to the pupa, and the various ways in which the cocoon offers protection to the pupa or future imago. In particular is this true of the Lepidoptera. That cocoons to an extent equalize rapid changes of temperature and prevent the loss of moisture by the pupa, is beyond a doubt. But that they offer protection against other natural destructive agencies, such as mice and birds, is, in the case of the latter, to a certain extent untrue. There is at least one bird, the hairy woodpecker (*Picus villosus* Linn.), from whose beak the staunch cocoon of the Cecropia offer no protection whatever.

In the early part of the winter of 1879–80, I noticed one of these birds clinging to a twig, pecking away at the parchment-like covering of a cocoon attached thereto, in a manner that amused me very much, and I was hugely enjoying its (as I supposed) vain

attempts to penetrate it. But when it hopped to an adjoining limb, shook itself and performed in a manner which years of observation had taught me was not indicative of a hungry bird, I began to think its powers had been vastly underestimated. By the aid of a ladder the cocoon was obtained and found not only to have been punctured, but all the soft and liquid parts extracted. As there were others attached to the same tree which upon examination proved to be uninjured, I was led to believe the bird had found a weak part.

After a few days these were examined and another found to be punctured, this time fairly upon the crown and apparently in the strongest part. I now saw what had before escaped my notice, viz: that by the situation of the first cocoon it was accessible to the bird only from below, which accounted for the puncture being near its base, close to the twig. A short time afterward, on passing another tree, out from among the branches flew the little murderer, and, as usual, a punctured cocoon was found, the puncture yet wet with the juices of the pupa, showing that I had surprised the bird while at breakfast.[1]

Afterward an examination of over twenty cocoons, found in a small grove of *Negundo aceroides*, showed only two uninjured.

That the birds were not in quest of parasites is at once evident, as a parasitized larva of one of these moths reaches only the first stages of the pupa state, as the many cocoons I have examined contained only the dried skins, in nearly all cases, of larvæ apparently having expired immediately after having constructed their cocoons, leaving at this season nothing containing any liquid matter whatever, and nothing to afford nourishment for birds.

A year has gone by, and at this date (January) the little destroyers are at work, and I can easily distinguish the dry rattling sound, the death knell of the beautiful moth, the larva of which seems to be as destructive to vegetation as the imago is innocent. So far as I have been able to observe, the birds do not attack these cocoons (a number of which accompany this paper) until winter, when other insect food is not so easily obtainable. In fact, this seems to be a source of subsistence stored up for this season of the year, always fresh and, to all appearances, at all times available.—*F. M. Webster, Waterman, Ills.*

NOTES ON THE ELM-TREE LEAF-BEETLE (GALERUCA XANTHOMELÆNA).—Perhaps the following may in part answer some of Dr. LeConte's inquiries about the imported elm leaf-beetle. My first acquaintance with the insect was in October, 1877. My friend, Mr. H. L. Otterson, a farmer, of Cream ridge, New Jersey, drew my attention to a strange foray of "squash bugs" (as he called them) in the garret. They swarmed in every hiding-place, seeming to take special delight in the old clothes and certain rolls of

[1] This cocoon was opened nearly two months afterwards at the Bloomington meeting of the Illinois State Nat. Hist. Society, and the pupa found to be still alive.

woolen remnants. He stated that they had appeared in great numbers the previous summer on the large elm shade tree near the house, and that the tree, at the end of the summer, looked as if its leaves were nearly gone, but he did not examine the leaves; "and now," said he, "the pests have taken possession of the house." I pointed out to him that though to the popular eye they did look like squash beetles (*Diabrotica vittata* Fabr.), they were a different affair; but that they would do no injury to the house other than by being an annoyance, as next spring they would doubtless, if allowed to, get out of their dwelling and into the the trees again.

I have followed up the career of this Galeruca as well as I could. Upon this particular farm, which had three elms on it, the history is briefly this: They appeared about the first of May, 1877, suddenly and in great numbers. They hibernated in the garret three winters, getting out of the house in May following each winter. In trying to get out of the house in May, 1880, they swarmed on the inside of the windows, and large numbers were destroyed by brushing them into a pan of scalding water. Their depredations on the three trees were through four summers. The leaves would be eaten off, and a new sickly crop follow early in the fall. My friend is afraid that the trees cannot recover. He did not observe the "worms." The beetles have not been found in the house this last fall or present winter, and they were not so numerous on the trees last summer.

In May, 1879, one of our students at New Brunswick, N. J., brought me several specimens of *G. xanthomelæna*, which he caught on the curtains of the parlor windows. They were trying to get out of the house, having hibernated there. The house is in the city and has elm shade trees. The same youth directed my attention to the fact that these insects were in quantities in the gymnasium loft of Rutgers' College Grammar School, and there they had hibernated two winters. The shade trees are elms. They have been three years in New Brunswick. The first time they appeared suddenly and in quantity, and their depredations set the citizens to work scraping and cleaning the bark. The second year they came in less numbers, and still less the third year.

These observations simply cover the following points: 1. Their first appearance is sudden and in numbers. 2. Either the imago or larvæ or both are voracious leaf eaters of the elm. 3. The imago hibernates; and 4, it has a penchant for the protection of buildings. 5. Judging from the freshness of all the specimens I have seen, I should think the beetles were but just evolved from their pupæ when they seek their winter quarters. If this be so, their life cycle is a rapid one, the egg in May and the imago in early autumn. But this must be determined by actual experiment.

I have queried whether their great numbers at the first observed appearance may not be due to the almost entire absence of natural enemies, and their subsequent decrease to the presence of the same.—*Samuel Lockwood, Freehold, N. J.*

[The development is far more rapid than our correspondent supposes. There are at least three generations at Washington, and doubtless more than one in New Jersey.—ED.]

FOOD HABITS OF SAPERDA CRETATA.—In your recent valuable article on the food-plants of *Cerambycidæ* I notice that no mention is made of *Saperda cretata*. This beautiful species, an account of which I published in the *Western Stock Journal and Farmer* (Dec. No., 1880), has been been taken from the branches of apple trees and specimens of both the insect and its work sent me by Mr. C. G. Patten, of Charles City, Ia.

The eggs are evidently laid in pairs, half an inch or more apart along the branch, the larvæ of each pair upon hatching, working in opposite directions around the branch, at first just beneath the bark, but afterward (probably after the first year), entering the hard wood.—*Herbert Osborn, Ames, Iowa.*

HYBERNATION OF THE COTTON WORM MOTH: EASE WITH WHICH MISTAKES ARE MADE.—Mr. I. A. Wimbish, of Cuero, DeWitt Co., Texas, writes as follows:

I enclose you one of several moths (*Aletia argillacea*) captured on the evening of the 4th of December (thermometer 62° F., wind S.E.), whilst flying around the lamp in my bed-room. For some weeks previous the temperature had varied from 22° to 48°, the prevailing winds having been N. and N.E. Such a low degree of temperature is unusual in our locality, and rarely occurs more than once during an entire winter.

FIG. 1.—*Aletia argillacea.*

The presence of this moth, at this time, I regard as very good evidence of the truth of the hibernating theory. If this pest can survive such weather as we have already had, the probability is, that there will be no further danger during the remainder of the winter.

Before closing this note, I will take occasion to remark that I have been a resident of this county since 1851, and have planted twenty-eight crops of cotton. Of this number, I have never raised a crop, until the present year, which was not more or less injured by the worm, the damage varying from thirty to seventy-five per cent.

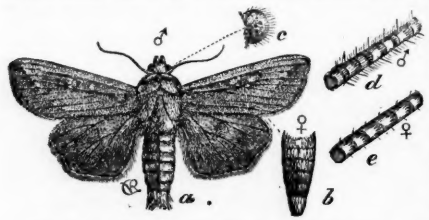

FIG. 2.—*Leucania unipuncta; a*, male moth; *b*, female abdomen, natural size; *c*, eye; *e*, portion of female antenna; *d*, do. male (after Riley).

This year, 1880, from the liberal use of London purple —thanks to your investigation and suggestion — the damage has been scarcely appreciable, the fields remaining perfectly green and fruiting until frost, Nov. 5th and 6th, and are now still white with unpicked cotton.

The specimen sent by Mr. Wimbish was so badly rubbed and

broken that it would have been past recognition by any one not thoroughly familiar with the cotton-worm moth, and the other species so apt to be mistaken for it. Yet correct determination is most essential in all such questions and by the ovipositor alone we recognized the specimen as that of the common army-worm *(Leucania unipuncta)*. For the benefit of the general reader, and especially of our Southern friends, who are most deeply interested in the question, we give herewith illustrations of both these moths. The ovipositor of the female Aletia is a simple, slightly extensile, cylindrical tube, while that of the Leucania, as shown in Fig. 3, is a compressed, narrow, blade-like, horny process, easily recognizable when all other characters of the species are obliterated. We may say, *en passant*, that on account of the general similarity of color and the frequency with which it occurs in the Southern States during winter time, this Leucania is the most liable to be mistaken for the Aletia.

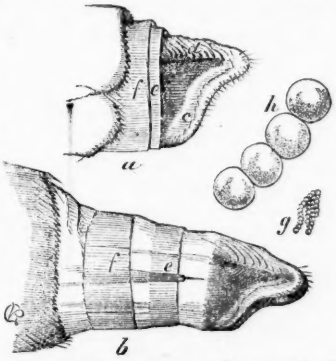

FIG. 3.—Army-worm moth; *a*, end of abdomen denuded and showing ovipositor at rest; *b*, same with ovipositor fully extended; *e*, *f*, retractile subjoints; *h*, eggs —all enlarged; *g*, eggs, natural size (after Riley).

PYRETHRUM SEED.—I have obtained direct from Europe some seed of *Pyrethrum roseum* for distribution among the agents of the U. S. Entomological Commission, with a view of introducing this valuable plant in various portions of the country where it may be acclimated. I have a small quantity to spare to such of the readers of the NATURALIST as will agree to carefully sow the seed and cultivate the plants and report to me the results of the attempt. I should like to send it especially to those residing in the mountainous or more elevated regions of the South as well as in Colorado and about Lake Superior, and will send to such upon application.—*C. V. Riley.*

ANTHROPOLOGY.[1]

ANTHROPOLOGY IN MISSOURI.—The Academy of Science of St. Louis published two important additions to anthropology during the past year: "Contributions to the archæology of Missouri, by the Archæological Section of the St. Louis Academy of Science. Part 1, Pottery, by W. B. Potter and E. Evers. Naturalists' Bureau, Salem, Mass., 1880, 30 pp., 24 lith. pl., 5 maps, 4to;" and

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

two papers in Vol. IV, No. 1, of Transactions, entitled, "The Geological and Geographical Distribution of the Human Race," by the Hon. Nathaniel Holmes, and "Zoque, the language spoken at Santa Maria de Chemalapa, and at San Miguel and Terra Blanca, in the State of Chiapas, Mexico," by Antonio de Coruna y Colludo, translated by J. A. Dacus.

The memory of pleasant days passed with our friends during the meeting of the American Association in 1878, and of the valuable collections which they have made at great expense, is reawakened by the appearance of these two volumes. The paper of Judge Holmes is in the nature of a lecture upon the origin and early migrations of our race. Starting out with Mr. Wallace's six zoölogical provinces; Palæarctic, Oriental, Australian, African, Nearctic, and Neotropical, it is assumed, "that man's distribution over the earth must have pursued an analogous course, under the threefold operation of evolution, migration over continuous areas, and extinction in some areas." The author considers it scientifically demonstrated that man existed in Europe in the Miocene period. After passing in review the Canstadt, Cromagnon and Furfooz races of western Europe, Judge Holmes turns aside to combat Professor Dawkins' theories concerning the post-tertiary origin of man and the identity of the Eskimo with the cave-dwellers of Dordogne.

As to our own country, it is held that the earliest existence of our race, was in the Pliocene of the Pacific coast, and that they progressed to the Atlantic border when the land communication was established across the continent. The subject of bands of color coördinated with other racial characteristics, of the pristine home and the migrations of men, the causes of racial differences, the peopling of America, and of plurality of origins are thoughtfully considered.

The Zoques were once a powerful nation, extending from Tehuantepec through Tabasco and Chiapas into Oaxaca, now numbering from 2500 to 3000. At present they are confined to a small district and two mean villages, Santa Maria de Chemalapa and San Miguel. Their language belongs to the Maya-Quiche, most nearly related to the Tzendal-Maya. Three pages of vocabulary accompany the paper on the Zoques.

The work of Professor Potter and Dr. Evers is destined to become a classic upon the archæology of Southwestern Missouri. We have in their monograph a neat quarto resembling very much in outward appearance the Smithsonian separate Contributions to Knowledge, and containing: 1. A paper on the archæological remains in south-western Missouri, by Professor W. B. Potter, which is a model of brevity and precision (pages 5–19); 2. A paper on the ancient pottery of south-eastern Missouri, by Dr. Edward Evers, which is exceedingly cautious as to its theories (pages 21–30); 3. At the close of the text are five maps to illus-

trate Professor Potter's paper, and twenty-four lithographic plates containing one hundred and forty-nine figures drawn to a scale by Dr. G. Hambach, to illustrate Dr. Evers' paper. Excepting a few faults of proof-reading, the press-work and illustrations are all that could be desired.

One must study this volume with a good map of Missouri before him. The geology of the south-eastern corner of the State is well described, especially the ridges bounded by bayous upon which the remains are located. Two ridges are included within the present survey: the "Sandy Wood Settlement," near the town of Diehlstadt, in Scott county; and the "New Madrid and Sikeston Ridge," in New Madrid county. The latter ridge furnishes four settlements besides several scattering mound sites. The especial characteristics of these village sites are an earth wall and ditch enclosing a given area, an oblong principal mound, around which is an elliptical clear space, innumerable lodge-hollows filling the remainder of the enclosure beyond the clear space, and, finally, here and there, burial mounds, from which hundreds of skeletons and many thousands of specimens have been exhumed.

It is very difficult to abridge Professor Potter's terse description, and we regret the want of space to give even his summary (pages 17–19).

In Dr. Evers' portion of the volume will be found descriptions of the materials, shapes, coloring and decorations of the pottery.

The material is a dark, grayish clay, mixed with sand and shells, and sun-dried. (On the last point, see Professor Putnam's excellent review of this work in the *Sc. Am. Supplement*, Jan 1, 1881, 4161–4163.) The color is generally black, and, in some specimens, moulded in the clay. The decorations are red, white and black, not burned in.

In shape the vessels are classed as long-necked; short-necked; wide-mouthed, shallow dishes, with or without handles; gourd-shaped; animal-shaped; and those exhibiting the human form. A few forms are suggestive of Peruvian, Central American, Pueblo, cliff-dwelling, and even Asiatic pottery; but Dr. Evers as well as Professor Putnam have evidently learned caution through a large experience. The greatest variety in supporting the vessels is exhibited in Dr. Hambach's drawings.

The ornamentations are either moulded in the vessel, luted on the surface, incised, or painted on the outer surface (very rarely on the inside). The author makes an observation with reference to the design of these varied forms of embellishment which strikes us very favorably indeed. It might be called "the law of the least marvelous." He contends that ancient implements must not be referred to any function more important or significant than a corresponding one of the present day.

In conclusion, the NATURALIST extends its congratulations to

the St. Louis Academy of Science upon the prosecution of an investigation so thorough that it will never need to be repeated.

THE STUDY OF INDIAN LANGUAGES.—Major J. W. Powell has just issued a second edition of "Introduction to the Study of Indian Languages, with phrases and sentences to be collected. Washington, 1880." Although purporting to relate to language alone, the work covers the whole ground of anthropological research. Chapter I is a discussion of the alphabet, together with the best method of transliterating an Indian language. Chapter II is headed Hints and Explanations, and is a preparation for the lists of phrases and sentences to be collected in the schedules. These are divided into thirty-two sections, treating of persons, parts of the body, dress and ornaments, dwellings, implements and utensils, food, colors, numerals, measures, divisions of time, standards of value, animals, plants, geographic terms, geographic names, the firmament and meteorologic phenomena, kinship, social organization, government, religion, mortuary customs, medicine, amusements, new words, accidence, pronouns and transitive verbs, possession, intransitive verbs and the other parts of speech used as verbs, voice and mood and tense, the best method of studying materials collected, the rank of Indian languages. Chapter III is a collection of schedules containing a great variety of questions in order to bring out the truth with reference to each of the subjects named above.

In the back of the volume is a set of kinship charts which embrace both consanguinity and affinity for nine generations, including that of *ego*, four above *ego*, and four below *ego*. Instead of using the old-fashioned circles for the individuals in the group, found in Mr. Morgan's tables and elsewhere, the triangular characters used by the Indians themselves to denote man and woman are worked up with a series of colors so as to present to the eye at a single view, all the facts desired.

The alphabet presents a few innovations, which are usually very undesirable, but which in this case are on the whole an improvement, since they substitute a plain letter, which may be found in any printing office, for characters and logographs difficult to reproduce.

A PRE-HISTORIC ROCK RETREAT—In January, 1876, the late S. S. Haldeman, Professor of comparative philology at the University of Philadelphia, discovered on his farm near Chickies, Pa., upon the eastern bank of the Susquehanna river, a rock retreat of the prehistoric age, which yielded him, when he explored it with the spade, a large number of stone implements, and proved to be a locality where the occupation of arrow-making had been followed for a long lapse of time. This retreat, located in Lancaster Co., had been made the subject of several printed communications by Professor Haldeman, the last of which was the one read before the American Philosophical

Society of Philadelphia, Pa., June 21, 1878, and printed since in the Transactions, Vol. XV, page 351–368, with fifteen lithographic plates; one of these represents the rock recess with the railroad track running in front of it. The text accompanying the plates contains a statement concerning the probable age of the relics; thirty inches of black mold accumulated by decaying vegetation would seem to indicate to the author a time roughly estimated at two thousand years. The objects found are described under the following headings: Knives, chisels, scrapers, borers, arrow-heads, spear-heads, hoes and diggers, sinkers, hammer-stones, tomahawks of honor, pipes, cores and chips, pebbles, shells, bones, pottery; the latter showing a large number of different patterns. The professor's remark (page 354), that the name "celts" given to the stone chisels, should be restricted to the people who bear this name, is not quite to the point, for this term, in Greek, κέλτης, stands in no connection whatever with the national name of the Celts; but is related to the Latin verb *cælare*, to chisel out, to engrave; and to the substantives: *cælatura*, the art of chiseling and that of making relievos; *cælamen*, a basso or mezzo-relievo; *celum*, the artist's chisel.

ANTIQUITY OF MAN.—In the *Princeton Review* for Nov., Principal Dawson reviews Dawkins on early man in Britain, Barrande's "Brachiopodes," "Les Enchainements du Monde Animal," by Gaudry, and Saporta's "Le Monde des Plantes," in their relation to the antiquity of man and the origin of species. Objecting to Professor Dawkins' classification of the later tertiary, the writer suggests the following: I. Pleistocene, including *(a)* Early Pleistocene and *(b)* Later Pleistocene; II. Modern, or period of man and modern mammals, including *(a)* post-glacial and *(b)* recent. Exception is also taken with good reason to Dawkins' separation of the cave men from the river-drift men, and to his identification of his cave men with the Eskimo. On the next page, however, Dr. Dawson is not so hard to please, when he says that the connection of the Etruscans with the introduction of the bronze age into Central Europe, viewed in relation to their probable ethnic affinities with the neolithic and Iberian races, remarkably welds together the stone and the bronze age in Europe, and explains their intermixture and "overlap" in the earlier lake habitations of Switzerland and elsewhere. The portion of the paper germane to our notes closes with an endeavor to recall the historical deluge as a force in the production of those physical changes which separate the deposits containing the remains of palæocosmic man from those of later date. The paper appears in full in the *Kansas City Review*, for January and February.

THE AZTEC DICTIONARY OF FATHER AOLNZO DE MOLINA is a most important help for the study of the Aztec or Mexican language, and since it gives the ancient, uncorrupted forms of this sonorous tongue from a time dating but little after the conquest, it is high-

ly appreciated by all Mexicologists. The number of Aztec terms contained in each of the two parts, Spanish-Aztec and Aztec-Spanish, cannot fall much short of thirty thousand. The great scarcity of both editions (1565 and 1571) has raised its price rather high, but through Platzmann's recent re-publication of the second edition linguists are now enabled to acquire this "Thesaurus" at a very moderate figure. The new edition reproduces the work in *fac-simile* and bears the following title: "Vocabulario de la Lengua Mexicana, compuesto por el P. Fr. Alonso de Molina, Publicado de nuevo por Julio Platzmann, Leipzig, B. G. Teubner, 1880, Quarto." The volume is dedicated to the memory of the Empress Catharine II., of Russia, the first sovereign who encouraged linguistic researches within the limits of her vast domains in Europe and Northern Asia.

THE INDO-CHINESE AND OCEANIC RACES.—Mr. A. H. Keene, of whose work the NATURALIST has frequently made mention, commences in the number of *Nature* for Dec. 30, a series of papers on the Indo-Chinese and Oceanic Races—types and affinities. The following scheme will be followed in the discussion:

A. DARK TYPES.

I. NEGRITOS: Aetas; Andamanese; Samangs; Kalangs; Karons.

II. PAPÛANS: { Central branch—Papûans proper. / Western branch—Sub-Papûans, West (Alfuros). / Eastern branch—Sub-Papûans, East (Melanesians).

III. AUSTRAL: Australians, Tasmanians?

B. CAUCASIAN TYPE (Fair and Brown).

IV. CONTINENTAL BRANCH: Khmêr or Cambojan Group.
V. OCEANIC BRANCH: Indonesian and Sawaiori or Eastern Folynesian Groups.

C. MONGOLIAN TYPE (Yellow and Olive Brown).

VI. CONTINENTAL BRANCH: Indo-Chinese Group.
VII. OCEANIC BRANCH: Malayan Groups.

THE PAWNEE INDIANS.—Mr. John B. Dunbar, of Deposit, New York, contributes to the November number of the *Magazine of American History* a paper of twenty-four pages upon the Pawnee Indians, describing their trade, food, feasts, hunting, war and medicine. The list of food plants and the discussion of the practice of medicine are especially good. It has been asserted in very high quarters that the Indian of this continent had primarily no knowledge of the medicinal properties of herbs aside from incantation. It might be well for Mr. Dunbar to give this question a little attention. Sooner or later some scholar or group of scholars will publish an encyclopædia of our Indian tribes, and for this work such monographs as the one under consideration are a necessary preparation.

THE WESTERN RESERVE SOCIETY.—From our esteemed correspondent, Col. Charles Whittlesey, we have received a tract entitled "The Universal Indian Problem," and No. 50 of the pam-

phlets of the Western Reserve & No. Ohio Hist. Soc., containing the Indian narrative of Judge Hugh Welch, and Wyandotte missions in 1806 and 1857, both edited by Mr. C. C. Baldwin. The former is a letter to General Garfield on the subject of Indian education, which takes a rather gloomy view of the subject. Of the latter, as well as of all the publications of this society, we take great pleasure in saying that the permanent records of an association can be valuable in the highest degree without being in the least costly or pretentious.

THE CENSUS OF ALASKA.—The *New York Herald* for January 10 and 11, gives a detailed account of the exploration of the Alaskan peninsula for the purpose of enumerating the population, and of studying the habits of the natives. No one better fitted for this service could have been found than Mr. Petroff, who adds to his thorough knowledge of the Russian and English, a practical acquaintance with ethnology, acquired while assisting Mr. Bancroft in the preparation of his great work on the native races of the Pacific States. Mr. Petroff will prepare an elaborate paper on Alaska for the next census and will contribute a memoir to the volumes of the Ethnological Bureau.

THE DAVENPORT ACADEMY, IOWA. — The Davenport *Daily Gazette* for January 6, 1881, contains the record of the annual meeting of this thriving society. The retiring president, Mr. Pratt, devoted the annual address to the discussion of the mound-builders. Mr. J. Duncan Putnam was elected president for the ensuing year, and Dr. C. C. Parry, corresponding secretary. Notice is given that the printing of volume III will be resumed at once.

GEOLOGY AND PALÆONTOLOGY

APPARENT GLACIAL DEPOSITS IN VALLEY DRIFT.—While collecting facts regarding the question whether there was in Maine a re-advance of the glacier subsequent to the deposition of the sedimentary Champlain clays and valley drift, the writer observed certain large boulders lying on or in the valley drift which seemed too large to have been deposited by any of the ordinary forces of valley transportation. Sometimes numbers of boulders were found in pell-mell masses quite morainal in appearance, and I was for a time inclined to regard them as glacial. The smaller stones and boulders might readily be supposed to have been carried down in spring by floating blocks of ice, but the largest of them staggered me, until one day I found a boulder weighing not far from one hundred tons lying on the undisturbed silt of the present flood plain of the Piscataquis river. Its history was as follows: Ever since the first settlement of the country that rock had stood right in mid-channel, a constant object of apprehension and vituperation to the lumbermen, for many were the "jams" of logs which it had caused, some of them of large size. But nothing

moved it perceptibly until a few years ago, when, during a mid-winter flood, a great ice gorge formed against it and a very high dam soon extended to a considerable distance on each side of the river. When, at last, the ice rushed downwards with irresistible force it wrenched the offending rock from its bed in the till, pushed it up a steep bank twelve feet high, and left it two hundred feet back from the river, together with large piles of stones and boulders. The flood plain, being frozen, suffered but little erosion. Many similar facts have since been observed. Evidently if blocks of granite ten or more feet in diameter can be tossed about like this, then in the case of narrowish valleys subject to floods and ice gorges, the presence in the valley drift of erratics and masses resembling moraines is to be received with great caution as a proof of glacial conditions, unless the deposits are very abundant and continuous, or are supplemented by striæ or other positive indications. So also the development of the aasar or kames seems to show the frequency and great transportive power of ice gorges in the channels of the glacial rivers. During the decadence of the great glacier, transportation of this kind would probably be active all along the line of the terminal moraine, more particularly in the valleys of those streams whose headwaters were in the region covered by the ice, such, for instance, as the valleys of the Delaware, Susquehanna and Allegheny. At least they deserve careful investigation for such deposits.—*George H. Stone, Kent's Hill, Maine.*

Extinct Palæozoic Fishes from Canada.—At a recent meeting of the Natural History Society of Montreal, Mr. Whiteaves read a paper on "Some new and remarkable fossil fishes from the Devonian rocks of the northern side of the Baie des Chaleurs." He commenced by remarking that until last year a long strip of the northern side of the bay had been mapped as belonging to the conglomerates of the Bonaventure formation, which form the base of the Carboniferous system. Last year, however, Mr. R. W. Ells, of the Geological survey, discovered a fine specimen of a fossil fish belonging to the genus *Pterichthys*, of Agassiz, in Escuminac bay, a discovery which led to a careful re-examination of the locality by Messrs. R. W. Ells, T. C. Weston, and A. H. Foord. From the researches of these gentlemen, we now know that at this point Devonian rocks crop out from under the Bonaventure conglomerates, and further, that these Devonian rocks hold a rich and extremely interesting series of fossil plants and fishes. The vegetable organisms will be described by Principal Dawson at some future time, but the fossil fishes, of which many specimens were exhibited at the meeting, were shown to belong to the following genera and species:—1. *Pterichthys.* A fine species, supposed to be new, which has been described in the August number of the *American Journal of Science* as *Pterichthys canadensis.* 2. *Diplacanthus;* a cluster of fin rays only, of a small

form, possibly referable to this genus. 3. *Cheirolepis.* A beautifully preserved fossil fish, about a foot in length, which cannot at present be distinguished from the *Cheirolepis cumingiæ* of Agassiz, which was so named in honor of Lady Gordon Cuming, of Altyre. 4. *Phaneropleuron*, nov. sp. 5. *Tristichoporus*, nov. sp. 6. Portion of the vertebral column of the above species of *Tristichoporus* shewing the neural and hæmal spines and the processes which support the rays of the tail, also the two ischiatic bones with the metatarsals attached, which must have formed the bases of two enormously developed ventral fins.

The Millstone Grit in England and Pennsylvania.—In the February number of the *Amer. Journ. Science*, Mr. Chance, of the Geological Survey of Pennsylvania, calls attention to the remarkable parallelism between the stratification of the Millstone grit in Pennsylvania and England. He gives the following comparative sectional tables from the reports of the two countries:

Yorkshire.	*Pennsylvania.*
Rough rock.	Homewood sandstone.
Shales (sporadic coals).	Mercer coal group.
Second grit.	Conoquenessing Upper sandstone.
Shales (coal).	Quakertown coal.
Third grit.	Conoquenessing Lower sandstone.
Shales (coal).	Sharon coal.
"Kinder Scout" grit.	Sharon or Ohio Conglomerate.

Over large areas this nomenclature is applicable to all vertical sections in both Yorkshire and Western Pennsylvania. The top and bottom sandstones are especially durable and constant, and form "key rocks" in both countries, for the determination of other horizons.

A New Fossil Bird.—The Amyzon Shales of the South Park of Colorado have furnished many fine specimens of insects, fishes and leaves, and a very fine bird, with feathers well represented. The latter was described by Mr. J. A. Allen as a finch, under the name of *Palæospiza bella*. It is interesting to learn that another bird has been procured from the same bed. The specimen includes the posterior half of the body including the hind legs. The tail feathers are preserved in place. The characters are those of a wading bird, and Professor Cope describes it in the current number of the Bulletin of the U. S. Geological Survey of the Territories, of Dr. Hayden, under the name of *Charadrius sheppardianus*. It is dedicated to the zoölogical artist, Edwin Sheppard of Philadelphia.

The Stream-Tin Deposits of Blitong.—Dr. Martin of Leyden has determined the age of the Stream-tin deposits of Blitong (or Biliton), by means of an extensive series of *Mollusca* obtained from it. They number sixty-one species, of which only two are certainly new to science. The remainder are all recent species, excepting a *Cerithium*, which has hitherto been only known from

the strata of Mount Sèla in Java. *Prionastræa tesserifera* Ehrbg. exists at present only in the Red sea, but the remaining species are found in the sea of Blitong. The strata are determined to be posttertiary.

GEOLOGICAL NEWS.—Professor Marsh shows that the neural cavity of the sacrum in *Hypsirhophus (Stegosaurus) ungulatus* is ten times the size of the brain case of the skull of the same animal.——In the Acts of the Tuscan Academy of Sciences for November, 1880, M. De Stefani publishes a systematic table of the geological formations of the Apuan Alps. The principal formations are the Eocene, the Lias and the Trias.——The following statistics of the output of crude fertilizers from the beds of Beaufort and Charleston, South Carolina, is furnished by Mr. E. Willis: 1875, 122,790 tons; 1876, 132,626 tons; 1877, 163,220 tons; 1878, 210,328 tons; 1879, 199,566 tons; 1880, 190,763 tons; 1881 to Feb. 1st, 173,168 tons.——The United States Geological Survey of the Territories under Dr. Hayden, in closing its work, has just issued three geological maps of the adjacent parts of Wyoming, Utah, Idaho and Montana. They represent the regions of Bear lake, the water shed of the Snake and Green rivers, and the Yellowstone Lake region. They are beautifully executed.

GEOGRAPHY AND TRAVELS.[1]

FRANZ-JOSEF LAND REVISITED.—The Arctic explorer, Mr. B. Leigh Smith, sailed in the steam yacht *Eira* from Peterhead, Scotland, on the 19th of June, 1880, on a voyage of discovery. We condense from reports in the London *Times* and *Illustrated London News* the following account of his very successful trip.

The *Eira* is a steam vessel of three hundred and fifty tons gross, measuring one hundred and thirty-five feet in length by twenty-five feet of beam and carried a crew of twenty-five all told.

The island of Jan Mayen was reached about June 29th, and was found almost encircled with ice. Sailing along the edge of the main pack they endeavored to reach the east coast of Greenland, near Cape Bismarck, the farthest point reached by the Germans. On the 2d and 3d of July, they got among the bladder-nosed seals and shot over three hundred of these animals. They worked in towards the west until the 9th in 75° 40′ latitude; but the weather was foggy, and all the time the ice was getting closer and heavier, some of the floes met with being very large. On the 9th nothing could be seen from the crow's nest but ice closely packed, and the idea of going further west had to be given up. It was very discouraging to have to work their way back again; but it had to be done. They reached the open sea again on the 11th.

They steered northward again on the 13th, and on the 16th

[1] Edited by ELLIS H. YARNALL, Philadelphia.

they came upon block ice in 75° 50′ latitude and about 5° east longitude, and had to go eastwards towards Cloven Point—a well-known landmark to the north-west of Spitzbergen. Passing that point they anchored to a floe of land ice off Welcome Point on the 18th. The intention at this point was to steer north; but after more battling with the ice they had again to bout ship and make the best of their way to the open sea. It is mentioned as an unusual circumstance that the islands known as the Norways and Fair Haven were closed with ice. They anchored at the head of Smeerenburg Bay and took in water on the 20th; and, having sailed at once, were taken in a strong gale and had to seek shelter in Magdalen Bay. They lay there three days. The gale over, they sailed southward, and cleared the South Cape of Spitzbergen at midnight on the 30th of July, and next day came upon loose floating ice, which, as they advanced, got much closer; and about 9 P. M., when within twenty-four miles of Hope Island, they had to take a south-westerly course to get clear of the ice. They reached a point 76° latitude and 25° longitude, and wanted to work northward after rounding the ice towards Wiches or King Charles Land, but finding this impossible, they took a north-easterly course with the idea of getting to Franz-Josef Land. They reached the pack ice on the 6th of August in 77° 14′ lat., and the course had again to be changed. Thence they continued in a north-easterly course, leaving the ice to the west, until the 8th, when they reached 79° 4′ lat. and 45° 38′ east long., and met with ice again. From this point they took a northerly course, and encountered very misty weather. On August 10 they reached 79° 40′ lat. and about 46° 50′ east long.—the farthest north point yet reached in this direction. Nothing could be seen but ice in very large and heavy floes, although it was expected that land would have been in sight. They returned in the afternoon with the intention of making for Franz-Joseph Land, and after getting clear on the 11th were caught in a strong gale and driven south as far as 78° 17′ lat., and 46° 19′ east long. From this point they steamed right up, and on the 14th, at 8 A. M., they sighted the land. In the afternoon they anchored to a land floe, attached to an island off the mainland—some one and a half miles long. Here they found large numbers of walruses, and that evening the party shot no fewer than seventeen of them.

Next day they had to shift on account of the drifting of the ice, and in the afternoon anchored to a floe some two miles long at a distance of ten miles from the land. Far "inland" they found an enormous tree with branches and roots apparently complete as it had been torn out of the ground. It is a common thing to find driftwood in these regions, but an entire tree is a rare sight. It is likely that the tree was a Siberian larch, and that it had been washed down by some of the Siberian rivers. On the 16th they came upon another island, on which they landed, and erected a

staff on a cairn, in the center of which they left a record. On these islands a number of curious specimens were found. The last Dutch expedition sighted land westward of this, and called it Barents Hook. This point was also seen by Mr. Smith, and the *Eira* was steered towards the land. They passed the point close to the land in foggy weather. Early one morning they landed on the island some twenty miles from the easternmost point, and found luxuriant vegetation. While off this island they sounded and found the average depth to be from fifteen to twenty fathoms about a mile off the coast.

Very large icebergs were seen quite unlike those met with in Baffin's Bay. The Franz-Josef Land iceberg is a vast mass from one hundred and fifty feet to two hundred and fifty feet high and of great extent, with a perfectly level top. Breaking off from the glaciers which line the coast, these do not float southwards, and the direction of their drift is one of the problems which are waiting for solution.

The new country was forbidding enough. It was covered with a glacier extending down to the sea. Even the off-lying islands had their caps, and the land was only visible at long intervals, in black precipitous masses, rising up between the icy expanses; yet animal life was abundant. Two right whales were seen; there were great numbers of walrus and seals, and the ivory gulls were breeding on one of the islands.

At noon on the 18th they discovered a new harbor, which they had no hesitation in naming Eira Harbor, after their vessel. It is formed by two islands, and affords good anchorage of from five to seven fathoms. It is well sheltered from all sides. It lies in 80° 5′ 25″ north latitude, and about 48° 50′ east longitude.

Here the lofty cliffs formed a vast amphitheater, and below there was a flat plain where many hyperborean plants were growing. But the surrounding scenery was wild and desolate in the extreme. Nearly the whole coast was occupied by glacier after glacier rolling down to the sea, with black headlands abruptly rising through the ice at long intervals. The great size of the icebergs and the extent of glacier are indications that Franz-Josef Land is of vast extent.

This harbor was made a rendezvous, from which, the next few days, numerous trips were made up the numerous fjords which pierce the mainland to the north and north-west. From the point named by the Dutch, Barents Hook, they traced the land westward some 110 miles, and from the extreme north-west point reached sighted land 40 miles further to the north-west. They found that this land was divided from the newly-discovered islands by a sound, which seems to be an extension of Markham's Sound. Lying in this hitherto unexplored tract of sea they discovered seven small islands, each measuring four to five miles long, and four larger islands—these latter being in the vicinity of Eira Harbor

—the largest from eighteen to twenty miles long, and the smallest from six to seven miles long. They are all covered with glaciers and snowfields, with bluff, black headlands on the southern exposures, whereon was vegetation. A large quantity of Arctic flowers and other specimens was collected and brought home. On one of the islands close to the harbor were hills 1200 feet above the level of the sea, but large tracts of flats were seen stretching from the foot of the hills.

The final trip from Eira Harbor was made on August 24, and it was on that day that they reached the most northerly point yet attained in that direction—80° 20′ north latitude, and about 40° east longitude. From that point they could see land to the north-west, some 40 miles off, and it was supposed that this was but a continuance of the same coast line. This they intended to follow up, but they had again to give up the attempt in consequence of the ice driving along the shore and carrying the ship along with it. Mr. Leigh Smith's opinion is that, whether this land extends in a continuous line north-west or forms the outline of separate islands, it forms a very good basis whence to prosecute researches further northward. When they found further progress impossible they returned, and experienced very bad weather.

They made for Eira Harbor again, but found it full of loose ice. Proceeding eastward, they anchored in a small bay to the west of Barent's Hook. From that point they steamed south a little to clear a large quantity of ice that had come out of the fjords, and on the 30th of August they found themselves close to Cape Tegetthoff, which had been discovered by the Austrian expedition in 1873. In that expedition their vessel, the *Tegetthoff*, was abandoned, and the explorers persevered in their mission by means of sledges; but though they succeeded in establishing the existence of the land, they had to return and make for Nova Zembla in a boat. Mr. Smith made a search for any traces of the abandoned vessel, but found nothing except a "can" on Wilczek Island. They found fast ice between Hall Island and Salm Island, and also between the latter island and Lamont Island, so that there was no means of getting out to the east or north-east, and as the ice was coming down they resolved to try to cut across by Spitzbergen to Wiches Land, or, as otherwise called, King Charles Land. In this endeavor their common enemy, the ice, confronted them and compelled them to alter their course. They sailed close to the edge of the ice as far as 75½° north and 46½° east before they could get west. They reached Hope Island on September 10, and again endeavored to work northwards up the east coast of Spitzbergen, but on the 11th the weather became very rough, and for three days the ship was tossed about in strong gales. They encountered numerous small icebergs. Seeing that nothing could be done in this direction—a pack of ice being discernible in the distance—they took a westerly course until they sighted the

South Cape, and then steamed up Storfjord and anchored on the 17th near Genevra Bay. From a hill here they could see the sea to the eastward was clear of block ice, although icebergs could be seen floating about. From this point Wiches Land could be distinctly seen. Hinlopen Straits also seemed to be free of ice. On the 20th they anchored at the entrance of Walter Thymen's Straits—where they took in ballast—which were also clear of ice. On the 22d they were off Wales Point, and from there they sailed with a fair wind to Hammerfest, in Norway, which they reached on the 25th of September.

Careful observations were taken of the temperature and other meteorological tests made. The dredgings secured some very interesting specimens which have been preserved, and a large number of photographs of the places visited were obtained.

Mr. Leigh Smith's voyage is the most successful and important *summer* voyage that has ever been made in the Arctic Regions.

MICROSCOPY.[1]

Pathology of Acute Delirium. — Dr. Theodore Deecke, Pathologist to the New York State Lunatic Asylum at Utica, publishes in the *Am. Journ. of Insanity*, a paper on some changes in the ganglion cells of the gray cortex of the brain in acute delirium and their relation to those in acute insanity and in dementia. He disputes the opinion of some authors that the phenomena of delirium, as well as acute insanity itself, are merely functional, and, while associated with grave disturbances of nutrition, and perhaps material alterations in the vascular system, are not connected with any visible alterations in the structure of the nervous elements themselves. The first change noticed in the ganglion cells of the gray cortex of the brain, is the appearance over the body of the cell of a loose, granular covering, of a fatty nature, which must be attributed to a defective focal combustion or oxidation, brought about by an insufficient supply, to the tissues involved, of arterial or oxygenated blood. These conditions occur so frequently in cases of acute delirium, and acute insanity, that there can be no doubt of their pathological character. In more advanced stages of the affection, the structure of the cells becomes involved, and finally almost entirely destroyed, as described at length in the paper itself. The author's method of studying the objects in situ, with as little change as possible from their condition in life, is thus described: "The best results are obtained from the immediate examination of the fresh brain tissue. With a sharp knife, kept wet with water, to which a small quantity of glycerine has been added, or even directly in this liquid, microscopic sections can be made sufficiently thin and transparent to permit the use of all the higher magnifying powers applicable in histological investigations. The liquid in which the sections are

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

mounted is diluted glycerine; and no pressure is allowed to act upon the specimens other than that which the thin cover-glass exerts when of the embedding fluid so much is removed by blotting paper that it just fills out the empty space between the slide and the cover. Thus the margin only of the specimen comes in contact with the fluid, while its surfaces are spread out smoothly on the glass surfaces. In such preparations the vascular arrangement, the distribution of the nuclei of the neuroglia, and the ganglion cells and nerve fibers in their natural appearance and position, are brought to view with great distinctness. The long processes of the pyramidal cells, which extend toward the periphery of the convolutions, may be followed up to three and four times the diameter of the field of vision of a one-fifth objective. The condition and position of the nuclei and nucleoli of the cells can be clearly pointed out, as also the roots at the base of the cells, and their origin. All this, however, will not visibly be altered when the fresh sections are soaked for staining in a carmine solution, to which a little glycerine has been added. They imbibe a small amount only of the coloring material, yet some details of structure may become thus more distinctly outlined. I have, therefore, most frequently in successive sections employed alternately both methods."

FINE RULINGS.—In speaking of the modern microscopic rulings on glass, which have been regarded with so great and deserved an interest by all physicists, one cannot be too careful to discriminate fully between those that are known to be ruled and those whose ruling has been attempted but not yet demonmonstrated. It is self-evident that in attempting to rule lines 5,000,000 to the inch a band may be produced which does not consist of lines of that degree of fineness. There is no difficulty in arranging a machine to draw lines, theoretically, of any required degree of closeness. The register of a ruling engine can be so arranged and sub-divided as to indicate a spacing at the ruling point of one ten-millionth of an inch as easily almost as of one-tenth of an inch. But it may well be doubted whether such fine motion is actually imparted to the diamond point, or could be recorded upon the surface of the glass. It is becoming common to hear the higher bands of Mr. Fasoldt, claiming up to ten million lines to the inch, spoken of as actually ruled and only waiting an objective to reveal them. Such an error, made inadvertently by persons who would avoid it by a little reflection, as made in the last number of one of the most popular microscopical journals, gives a lasting as well as erroneous impression to non-scientific persons. Mr. Fasoldt's rulings are certainly remarkable and the lower bands are ruled with great success; but how far up the scale they continue to be ruled as distinct lines is certainly at this time an undecided question.

YE MICROSCOPE OF YE OLDEN TIME.—Under this title Professor E. F. Moody delivered an interesting lecture before the Microscopical Society of Camden, which has just been published in pamphlet form by the society. Incited by an engraving and description of John Marshall's new double microscope in the Lexicon Technicum, published in 1704, which presents many of the features of the instruments and their methods of arrangement and use at the present day, he reviews the history of the microscope and its discoveries in England during the last of the 17th and the early part of the 18th century, chiefly by means of extracts from the Philosophical Transactions of the Royal Society. The author is greatly impressed with the keenness of observation, scientific skill and rare deductive power which is displayed in the microscopical studies of those early days, and he gives them in the quaint and thoughtful words of their original publication. After the death of Lewenhoeck, and the acquisition by the Royal Society of his valuable legacy, consisting of a cabinet containing his microscopes and their accompanying objects, this brilliant age of microscopy came to an end, and the Transactions show nothing of corresponding interest until the sudden advent of the age of Wollaston near the end of the 18th century.

ABNORMAL ENTOZOA IN MAN.—Rev. Samuel Lockwood's paper on this subject, read before the New Jersey State Microscopical Society, is full of curious facts in regard to the rather unfamiliar and somewhat unprepossessing theme. It is published in full in the January number of the *American Journal of Microscopy*.

EXCHANGES.—Parties desire to correspond with persons who can furnish new material containing *Polycistina;* also *Podurœ* or spring-tails of various species. Address the Editor of this Department of the NATURALIST.

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SCIENTIFIC NEWS.

— The first number of *Papilio*, organ of the New York Entomological Club and devoted exclusively to Lepidoptera has made its appearance, and a very neat and pleasing one it is. It will be issued about the fifteenth of each month, the subscription price being $2 per annum. The publication committee are Messrs. A. R. Grote, Henry Edwards and T. L. Mead; subscriptions and communications should be addressed to Mr. Henry Edwards, 185 East 116th street, New York City. We hope that the journal will give stimulus to our knowledge of the metamorphoses of the Lepidoptera, which has been somewhat neglected; the paper of Mr. Coquillet on the early stages of some moths is, we hope, an earnest of what may follow. A number of new species of moths are described by Messrs. Grote, Neumoegen and Edwards; and the number is illustrated by a colored plate of *Edwardsia brillians* Neumoegen.

— One of the most industrious of European entomologists, and one whose works have excited a decided influence on the progress of American entomology, died December 30. We refer to M. Achille Guenée, whose general works on Lepidoptera contained descriptions of numerous North American Noctuidæ, Phalænidæ and Pyralidæ. In 1872 we visited the veteran entomologist at his residence in Chateaudun. During the Franco-Prussian war he took refuge in Geneva, where he worked at his favorite science. His works are thorough, reliable and comprehensive, and have been of incalculable value to American students. He was a lawyer by profession, was an officer of the French Academy, and received honors from various scientific societies.

— Zeitschrift für Instrumentenkunde, Organ für Mittheilungen aus dem gesammten Gebiete der wissenschaftlichen Technik is a new journal, devoted to a new subject, that of instruments used in physical and biological science. The list of editors is headed by Prof. E. Abbe of Jena, and undoubtedly represents a strong editorial corps; the *redacteur* or immediate editor is Dr. Georg Schwirkus. The journal occupies a new and important field, and will be of value to microscopists, as it contains a number of articles on microscopical and accessory instruments. It is of large octavo size, published at Berlin, by Julius Springer, the agents in this country being B. Westermann & Co. Price $4.50 a year by mail from Berlin.

— A full grown chicken was brought to the market of Shelbyville, Tenn., which was found to possess three legs. A *post mortem* examination, made by Dr. Fite, revealed the fact that the internal economy was even more queer than the extra leg. The craw, heart and lungs were natural, but the intestine, about midway of its length, subdivided into four distinct canals; these finally became reunited into one, and this, just before emerging from the body, divided into two distinct vents. The chicken was found also to have two distinct livers one on each side. The monstrosity is a fat and healthy looking subject.

— M. Humblot has lately sent to the Paris Museum of Natural History a fine collection of the mammalia and birds of Madagascar. They afford interesting illustrations of the modifications of which species are capable. M. Humblot has also sent home some live animals, whose habits are scarcely known. Among these are two Aye-Ayes (a mammal very singular in its organization, and of extreme rarity). Two species of *Hapalemur* were also sent (alive). They differ more from the makis than was previously believed.

— The Vienna Academy of Science proposes as the subject for the Baumgartner prize of 1000 florins, the microscopic investigation of the wood of living and fossil plants, in order to ascertain

whether it is possible to determine with certainty, from the examination of the microscopic sections, what the genus and species of the plants may have been from which they were taken.

— Mr. Angelo Heilprin was recently elected to the position of professor of invertebrate palæontology in the Academy of Natural Sciences of Philadelphia. Henry Carvil Lewis was elected to the chair of geology and mineralogy in the same institution. Mr. W. B. Scott has been made assistant professor of geology in the College of New Jersey.

— Étienne Mulsant, the veteran entomologist of Lyons, France, died Nov. 4th, 1880, at the age of 83. For half a century he has been one of the most active and voluminous of European entomologists, having published numerous volumes and memoirs chiefly upon French beetles.

— We have received the First Annual Report of the Museum of the Ohio Wesleyan University. Valuable collections of fossils and shells have been received, and the Museum appears to have been well remembered by its friends. Prof. E. T. Nelson is the curator.

— Nests and Eggs of the Birds of the United States, with text. By Thomas B. Gentry. Illustrated by elegantly colored lithographic plates, is announced by J. A. Wagenseller, Philadelphia. The work is not to exceed twenty-five monthly parts, at $1.00 a part.

— The Botanical Collector's Handbook, by W. W. Bailey, Instructor in Botany and Curator of the Herbarium in Brown University, is ready for the press and will be published this spring by Mr. George A. Bates, Salem, Mass. The price will be $1.50.

— The Ninth Annual Report of the Curators of the Museum of Wesleyan University for 1880 shows that unusual interest is being manifested in the perfection of the collections. Prof. W. D. Rice is the Curator; Henry L. Osborn, Assistant Curator.

— It has been recently shown by Dr. Fatio that natural-history collection (dry preparations) may be rapidly, easily, and without danger, freed from their various parasites by simple spraying of anhydrous sulphurus acid in their receivers.

— The skeleton of a finner whale from the Pacific ocean has just reached the Permanent Exhibition of Philadelphia, for Professor Cope. Its weight is over 12,000 pounds. Sixteen boxes of fossils arrived from Paris at the same time.

— The Belgian Entomological Society recently celebrated its twenty-fifth anniversary. Baron de Selys-Longchamps, the first President, to whom the Society owes so much of its success, was unanimously elected Honorary President.

— We have received a list of plants growing without cultivation in Malden and Medford, Mass., with some contributions to a

Flora of Middlesex county. Published by the Middlesex Institute.

— Professor E. T. Cox, formerly director of the Geological Survey of Indiana, is engaged in examinations of the antimony mines in Sonora.

— Dr. C. Parona, of Pavia, has recently published an essay on the Acinetæ in general, and described a new Italian form.

— The triennial meeting of the American Institute of Mining Engineers was held in Philadelphia, Feb. 15, 1881.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History, Jan. 19.—The meeting was devoted to archæological topics. Dr. C. C. Abbott, of Trenton, N. J., discussed the evidences of palæolithic man in the valley of the Delaware. Professor Henry W. Haynes compared the argillite implements found by Mr. Abbott with those of the palæolithic age in Europe. The Rev. G. Fred. Wright considered the age of the Delaware gravels. Remarks on these subjects were made by Mr. F. W. Putnam and others.

Feb. 2.—Mr. William Trelease spoke of the fertilization of *Salvia splendens* by birds. Mr. F. C. Bowditch remarked on the economy of the beehive. Mr. F. W. Putnam exhibited an Indian relic from the peat; and Mr. Lucien Carr spoke of the raising of corn by the Indians east of the Mississippi.

Troy Scientific Association, Jan. 17, 1881.—Mr. Wm. E. Hagan read a paper on the intellectual development of the United States.

New York Academy of Sciences, Jan. 3.—Mr. Thomas Bland read a paper on the relations of the flora and fauna of Santa Cruz, West Indies.

Jan. 10.—Dr. George M. Beard lectured on trance, or so-called hypnotism or somnambulism, its nature symptoms and varieties, with especial reference to mesmeric trance. His experiments were conducted on a class of human objects that have been under Dr. Beard's training, and with especial reference to the errors of prominent European observers.

Appalachian Mountain Club, Jan. 12.—President Cross delivered the annual address on the subject of barometric measurement of heights; and Professor J. R. Edmands read a paper on schemes for Appalachian maps.

Middlesex Institute, Jan. 5.—Frank S. Collins read a paper on "Darwinism." Twelve new names were added to the list of members. The first publication of *The Institute* was issued in the form of a catalogue of the plants of Malden, Medford and vicinity, with blank pages for notes preparatory to the final compilation of a complete catalogue of the counties' flora.

AMERICAN GEOGRAPHICAL SOCIETY, Jan. 11.—Commander J. R. Bartlett, U.S.N., read a paper on the recent investigations of the Gulf Stream by the U. S. Coast and Geodetic Survey steamer *Blake*.

Jan. 25.—Gen. G. W. Callum read a paper on the Land of Egypt.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

AMERICAN JOURNAL OF SCIENCE AND ARTS.—February. Notes on Alaska and the vicinity of Behring strait, by W. H. Dall. Relation of Devonian insects to later and existing types, by S. H. Scudder. Date of the Glacial era in Eastern North America, by G. F. Wright. A new genus and species of air-breathing mollusk from the coal measures of Ohio, by R. P. Whitfield. Principal characters of American Jurassic Dinosaurs, by O. C. Marsh, Part IV.

ANNALS AND MAGAZINE OF NATURAL HISTORY. — December, 1880. Note on *Pterygodermatites macdonaldii*, the type of a new order of Vermes, by G. E. Dobson. On the minute structure of the recent *Heteropora neozelanica* and on the relations of the genus Heteropora to Monticulipora, by H. A. Nicholson. On the northern species of Buccinum, by J. G. Jeffreys. On the organization and development of the Gordii, second note by A. Villot.

GEOLOGICAL MAGAZINE—January. On the ornithosaurians from the Upper Greensand of Cambridge, by H. G. Seeley.

QUARTERLY JOURNAL OF MICROSCOPICAL SCIENCE—January. On the germination and histology of the seedling of *Welwitschia mirabilis* by F. O. Bower. On the head-cavities and associated nerves of Elasmobranchs, by A. M. Marshall. Contributions to the minute anatomy of the nasal mucous membrane, by E. Klein. Histological Notes, by E. Klein. On the intra-cellular digestion and endoderm of Limnocodium, by E. R. Lankester. (Shows that in the Cœlenterates, as previously shown by Metschnikoff, the endodermal cell take in natural food materials. In the fresh water medusa Lankester has studied the amœboid endodermal cells during life and seen them take in natural food materials, such as Protococcus and Euglena-like forms. He cites the observation of Parke, who saw a diatom completely embedded in the protoplasm of a cell of Hydra, also of Metschnikoff, who has described the inception of solid food particles by the cells lining the alimentary canal of certain Planarians.) On the microscopic numeration of the blood corpuscles and the estimation of their hæmoglobin, by Mrs. E. Hart. Preliminary account of the development of the lampreys, by W. B. Scott. On some appearances of the red blood-corpuscles of man and other vertebrata, by G. F. Dowdeswell. Medusæ and Hydroid polyps living in fresh water, by G. J. Romanes.